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CONDON IS CLEARED BY ATOMIC ENERGY COMMISSION

It is to be hoped that this statement of the US Atomic Energy Commission confirming, after thorough examination of all evidence provided by the FBI and other sources, Dr. Condon's fitness to have access to restricted information on atomic energy will put an end to the public defamation of our distinguished colleague. We rejoice in the decision of the Commission—which under our present conditions deserves to be described as courageous—not to wait for the hearings before the House Un-American Activities Committee, which (despite Dr. Condon's repeated requests) have been postponed again and again. We seem to recall that this House Committee has the practice of never stating clearly that a man they have "investigated" has proved his innocence; but drops the investigation if it becomes "unprofitable", leaving lingering suspicions.

The prominence of Dr. Condon as scientist and public servant has not protected him from slanderous accusations or assured him a rapid and impartial disposition of his "case"; but at no moment could there be any real doubt in his mind or that of his friends of his final vindication. But what of the younger and less prominent scientists who find themselves in a similar predicament with less publicity, but also with less certainty as to the final outcome? The Personnel Security Review Board of the AEC had recommended waiting with the Condon decision until the House Committee ended its investigation. Is this Board similarly sensitive to the pressure of public and Congressional witch-hunting, when it comes to other, less widely publicized cases of men less eminent in their fields? Does it feel its duty is to provide a quota of severed heads, just to show that it is not asleep? We have published several examples which make one almost believe that this is the case, and we have received evidence—which we intend to publish—of similar proceedings in government laboratories not under the jurisdiction of the AEC.

The civil rights of American scientists will not be assured until not only a man as prominent as Dr. Condon, but also the youngest graduate just out of college will be certain that he will not be subject to defamation and threatened in his livelihood without evidence other than malicious gossip or hearsay.

Complete Text of Commission's Statement Issued July 15:

The question before the Commission is the security clearance of Dr. Edward U. Condon, director of the National Bureau of Standards. In view of Dr. Condon's past association with the atomic energy project, this question arises under the provisions of the atomic energy act for reinvestigations of persons who were permitted access to restricted data by the Manhattan District. The question presented is whether Dr. Condon's clearance should be continued to permit him to have access to the restricted data pertinent to his duties as director of the Bureau of Standards and related activities.

After examining the extensive files in this case, the commission has no question whatever concerning Dr. Condon's loyalty to the United States. What we have for consideration, therefore, is whether the continued clearance of this distinguished American scientist, whose loyalty is unquestionable, would constitute a security hazard to the atomic energy program. Such a decision calls for a commonsense evaluation of the factors involved.

In considering the case the commission has taken note of the prior association of Dr. Condon with the atomic energy program, during which he was given access to information of a high degree of secrecy:

1. In 1940 Dr. Condon was appointed a member of the eight-man uranium subcommittee of the uranium section, National Defense Research Committee, which carried out the first overall survey of problems related to developing nuclear energy from atomic fission for the defense program.

2. In 1941 and 1942 Dr. Condon served as associate director of research of the Westinghouse Corporation, during the period when Westinghouse took a prominent part in the production of the first substantial quantities of pure uranium metal.

3. Also in 1942, Dr. Condon was appointed a consultant to the S-1 executive committee of the Office of Scientific Research and Development. This committee was charged with the responsibility for reviewing the basic program of the entire uranium project.

4. For a short period in 1943 Dr. Condon served as associate director of the Los Alamos laboratory, at that time in the early stages of its organization at the unit of the Manhattan project which would finally turn out atomic bombs. While at Los Alamos he prepared a document known as the "Los Alamos Primer," which was used as an introduction to the subject of the explosive use of fissionable material, to introduce to scientific and technical personnel coming to the laboratory the fundamental ideas under investigation.

5. In 1944-'45 Dr. Condon worked at the radiation laboratory of the University of California at Berkeley, which was under contract with the Manhattan District.

6. In November, 1945, Dr. Condon, having been appointed by the President and confirmed by the Senate, took office in the position which he now occupies as director of the National Bureau of Standards.

7. In December, 1945 Dr. Condon was designated and thereafter served as scientific advisor to the Senate's special committee on atomic energy.

8. In 1946 Dr. Condon was named by the President as a member of the evaluation commission for Operations Crossroads, and in this capacity attended the Bikini tests.

During the war the Bureau of Standards conducted for the atomic energy program of the Manhattan District certain work of types which the bureau was particularly suited to perform. The bureau has continued to perform for the Atomic Energy Commission similar work which can be best carried out by the Bureau. Thus, in his position as director of the Bureau of Standards, and in other related atomic-energy activities in which he would participate, Dr. Condon has need for access to certain types of restricted data.

This meant that under the atomic energy act Dr. Condon's security clearance required "reinvestigation;" that is, it was necessary for the F.B.I.

(Continued on Page 255)

"MIDDLE-RUN" PLANNING: ATOMIC ENERGY AND INTERNATIONAL RELATIONS

William T. R. Fox

The following article consists of excerpts from a chapter of TECHNOLOGY AND INTERNATIONAL RELATIONS, edited by William F. Ogburn, to be published by the University of Chicago Press next spring. Dr. Fox is a member of the Yale Institute of International Affairs, author of THE SUPER POWERS and co-author of THE ABSOLUTE WEAPON.

Two great power constellations dominate the world in which atomic energy is first successfully released. The Eastern colossus consists of a mighty Soviet nucleus surrounded by a band of states with "friendly" regimes which dance attendance on Moscow; friendliness is of course a criterion to be defined in Moscow and separately for each regime.

Within the Soviet Union proper that country's stern rulers are willing to see almost every other human value sacrificed to secure the absolute security of the Soviet fortress. Such total security the leaders cannot see in any pattern of accomodation with the West. Only the unanimity principle, called the veto on this side of the Iron Curtain, provides for them any satisfactory basis for cooperative action in the post-war world; for it leaves the Soviet leadership free to call a halt at any point.

The Western constellation of power is more loosely organized. It is a measure of the spontaneous and voluntary nature of collaboration among the Western powers that by no word or deed have responsible officials in Britain, Canada or any other Western state suggested that American bombs would under any conceivable set of circumstances be used against them. They have in fact acted very much as if American bombs were their bombs.

In one way the main current of American public opinion may be running in a direction different from that in Western Europe. Their own historical experience has taught Europeans to believe that international politics is a dirty business and that it will be with us a long time. To the American, European politics is a dirty business which he wants to see cleaned up in short order.

With the invention of atomic energy two new possibilities presented themselves for avoiding the prolonged and painful business of coexisting with a not particularly friendly power constellation whose base is in Eurasia. The first was to create "One World" and to create it in a hurry. The other was simply to rub out the offending Soviet power. Those who want an absolute solution for the problem of the absolute weapon sometimes assume that with Soviet rejection of the proffer of "One World," the United States is freed of any moral compulsion to seek a basis for coexistence through protracted negotiations leading to voluntary agreements on each of the host of problems disturbing Soviet-American good relations. Nevertheless, the problem of American foreign policy is not ordinarily considered one of finding a moral pretext for destroying Soviet power. Presumably, the problem is still to find a basis for peaceful coexistence.

The close surveillance which the Soviet government maintains and apparently means to maintain over its citizens' contacts with the outside world makes that government peculiarly reluctant to accept such close inspection that other powers would take the risk of all-round disarmament. More grave is the real doubt that the Soviet regime is inspectable, however anxious its leaders may be to admit the principle of international inspection. This latter thought need not detain us, for the point is academic until the will to permit thoroughgoing inspection becomes manifest.

The American position on atomic disarmament is in sharp contrast to that of historic possessors of new weapons. The Soviet Union has, it is true, called for the outlawry of atomic weapons, but it is certainly the United States which has taken the lead in proposals to make the outlawry effective.

Why this is so deserves consideration, for it helps one to understand the new power equilibrium in the era of American atomic monopoly and in the era which must one day follow.

The atomic weapon is not an all-purpose instrument. If American purposes are not those which the use of atomic weapons would aid in achieving, the United States position would be improved if no power had those weapons at its disposal. In a world in which other powers possess or are expected to possess atomic weapons, an American stockpile of bombs has an important political function: to discourage the use of bombs against the United States. In a world in which no other power has atomic weapons or any prospect of acquiring them, the foreign policy objectives which this country will wish to forward by using or threatening to use or even posessing such weapons are few indeed. In this latter world the American people, in terms of their own values, make no sacrifice in surrendering their present lead in the atomic armaments race.

Soviet-American Competition and the Prospects for Peace

It has from the beginning been clear that success in the quest for international control depends first upon the willingness of the United States to agree to weapon parity with the Soviet Union at some future date and second, upon the establishment of generally good relations between the two giant powers. The post-war collaboration which during the war had to be assumed was seen after the war as having first to be achieved.

Whether a general settlement of issues growing out of World War II would clear the ground for international action to banish the menace of two-way atomic war cannot be known. What does seem certain is that progress toward atomic energy control must wait upon progress in breaking the present general Soviet-American deadlock. Whether the American bomb monopoly interfered with the general peace settlement cannot be known either. It is possible that embittered Red-haters and Russophobes have been given by the combination of the American bomb monopoly and post-war Soviet political behavior an opportunity to utter the words "preventive war." Certainly preventive war would

not otherwise often be suggested as a formula for dealing with the Russians, and would not be now if Americans did not find the prospect of prolonged tension almost intolerable.

There is a more important way in which the introduction of atomic weapons may have affected adversely the prospect of amicable accommodation with the Soviet Union. It has permitted the rise of a new kind of isolationism. It is easier, says the latter-day isolationist, to hit the octopus in the eye than to cut off his tentacles one at a time. It is impossible, he continues, to hold the Rimlands of Europe and Asia in a new war anyhow. It is better to conserve the national energy for the main effort than to fritter it away in what will in another world war turn out to have been meaningless activity. Shoring up the sagging political structure of the European periphery is, he concludes, useless from a military point of view.

The decision to undertake a European Recovery Program shows that the neo-isolationist concept of national policy is not yet dominant. So does the widespread support for the President's desire to strengthen the Brussels Pact with American military aid. The large number of Congressmen who look benevolently on every effort to expand the Air Forces and seize every excuse to delay action on peacetime selective service and universal military training show, on the other hand, how attractive the new isolationist philosophy is.

What are the prospects for peace during the period of the American monopoly? The European Recovery Program and prospective military support for the states of Western Europe paid a first dividend in the form of the Communist defeat in the Italian elections of April 18 and 19, 1948. Whatever incentive Soviet leadership may have had to prolong the diplomatic deadlock, on the ground that time was on its side, was shown by that election to be disappearing. The Soviet government is more likely to seek to break the deadlock in 1949, if 1950 and 1951 would find the American position strengthened. Will they seek to break the deadlock by a return to the bargaining table or by general war or by something in between?

The American monopoly in atomic weapons furnishes part of the answer. It is widely believed that Soviet military power could initially drive American forces out of the whole of Western Europe; it is not so generally believed that the Soviet Union would emerge the victor in a Third World War in which the whole of the West backed up by the American bomb monopoly was allied against it.

Publicly Soviet leaders profess to believe that the political importance of atomic bombs has been exaggerated. Privately, they must be anxious to avoid atomic war, especially during the period of American monopoly.

Half-war or indirect war, such as the Soviet Union and the United States are now engaging in in Greece, will no doubt continue so long as unfriendly relations and a *mutual* disinclination to fight total war both persist. So will the rigorous use of economic and propaganda instruments in the battle for support in the in-between world. Atomic weapons are useless in half war and cold war except in so far as they prevent the development of total war and hot war. Only by being able to support its position in half war and in cold war will the United States be able to drive the Soviet Union back to the third alternative, a return to the bargaining table and a settlement of the diplomatic issues growing out of the Second World War. A fresh assault on the problem of the international control of atomic weapons would then become possible.

Is the United States also disinclined to let half war grow into total war? Only a widespread conviction that one-way atomic war sooner is the sole alternative to two-way atomic war later would permit United States action to bring about full-scale war. Any policy which offers the possibility of a Soviet return to a diplomacy of conciliation will almost automatically deflate any pressure for a preventive war.

The pessimistic prognosis of inevitable war assumes one of two things, neither of which is necessarily true. Either it is assumed that a two-power world will be even less stable than the multi-power world which preceded it and which has had recurring wars; or it is assumed that a two-power world can operate peacefully only if neither power is determined to dominate the world.

There may in fact be a basis for peaceful, though perhaps not cordial, coexistence in a two-power world in which one of the two has an unlimited appetite for expansion or is experiencing such insecurity that it finds no basis for satisfactory balance. If the power with the greater margin of unmobilized resources is a power which is pursuing a "live and let live" policy, then no matter how unlimited the demands of the second power, the first power would always be in a position to mobilize to just the extent necessary to thwart the second power's designs for expansion.

Mobilization "to just the extent necessary" will, however, require more than atomic arms. As Bernard Brodie pointed out: ". . . an American task force operating in the Mediterranean may have a stabilizing influence in the area which a strategic bombing force situated in Utah could not possibly have—regardless of the ultimate relative effectiveness of the two types of forces in actual war." With the new equilibrium resting on presence of scruple (or lack of determination) on one side and lack of weapons on the other a paradoxical conclusion emerges. The atomic energy inventions seem to be intensifying resort to precisely those types of political competition for which atomic weapons are least useful. To avoid war in such a world situation will require that the power of great potential keep itself prepared to take all measures short of general war.

Polarization of Power Will Keep Pace with Political Competition

Whatever form the political competition takes, the polarization of power will keep pace. Even if American policy succeeds in re-creating an independent Western Europe capable of adopting a common line of action against the pressure from the East, the result is likely to be an increasingly clean-cut division of the world into two spheres.

So long as atomic weapons are few in number, it will be important to the Soviet Union to force these few to be delivered from the greatest possible distance. Similarly, for many years after the Soviet Union has bombs, the significance of the number which it does have can be much reduced if the United States assures itself that the use of near-by bases is denied to Soviet planes. Thus, atomic defense policy is likely to reinforce the trend toward polarization and to focus world politics on ways of winning friends and influencing people in the in-between world.

As for the long-run relationships between great powers and small powers, opposing views have been developed. One thesis is that when the dozen or fifteen powers with an industrial base broad enough to support a primary plutonium plant possess atomic weap-

ons, there will no longer be any giant powers and pygmy powers. There will only be those which do and those which do not have atomic weapons. Another thesis, and probably a more accurate one, is that the genuinely independent small power with a few bombs would find that the bombs have little "blackmail" value. A few countries, like Sweden or Switzerland, with a determination to remain neutral, might, on the other hand, find respect for their neutrality strengthened.

Smaller industrial powers wholly within the security zones of the Eastern and Western giants might find that their possession of atomic weapons did not matter very much. The emphasis in Britain on the supreme need for fission products as energy sources, and Canada's public declaration that atomic weapons production is beyond her resources shows the reliance of both on the American stockpile. Russia could not stop British and Canadian development and the United States apparently will not. Any development behind the Iron Curtain would have the same political implications whether it occurred in Prague or in Stalingrad.

Thus, in the absence of international control, there are really only two important contingencies, monopoly and duopoly. Atomic energy may have outmoded pre-Hiroshima government areas only to introduce a new area of political control larger than the national state but not yet world-wide.

Whether or not a reliable system of international control is created, an enlargement of the scope of state activity will be necessary if democratically organized states are to reduce their vulnerability to atomic attack. No great state, with or without international control, nor any world government, can afford to adhere to a political and industrial organization which would permit a complete paralysis of government to occur as a result of the successful delivery of a few bombs to key targets in such areas as Washington, New York and Pittsburgh. In fact, the prospect for successful control would be much improved by having some of the most obvious targets made a little more difficult to destroy. It would give the control plan a margin of permissible inefficiency. A modest and sensible program of decentralization would assure the failure of a sneak attack based on the illicit production or diversion of material for a few bombs. In the absence of international control it would also assure the failure of a sneak attack based on the uncontrolled production of a relatively small number. Thus, this kind of national action to reduce vulnerability will support international control if it is established; if on the other hand, control is not established, it will prolong the period during which the United States can have security based on effective monopoly and, if it chooses, continue to negotiate for international control.[1]

What Will Defense Policy Be When U.S. No Longer Has Bomb Monopoly?

Also of equal deterrent value to a power contemplating a sneak attack with a few bombs would be for its prospective victim to have many bombs with which to make a devastating retaliation. There are other ways too in which national policy can reduce the attractiveness of atomic attack by preparing in advance a wholly unwelcome counterblow. It has been pointed out, for example, that Soviet development of rocket warfare can render the British Isles a hostage to United States good behavior. Furthermore, elaborate advance planning to maintain the striking power of military units, even though the base of central direction may have disappeared, will further reduce the opportunity for cheap and successful atomic aggression.

Even in the period of American monopoly, United States defense policy will be dominated by considerations of American security during a later post-monopoly period. Already the accent in defense policy is on preparedness before the moment of supreme crisis rather than mobilization after. With this shift of emphasis we may say that the last insular power has disappeared from world politics.

The radical expansion in state activity inherent in any adaptation to the atomic inventions is perhaps best symbolized by the nearly unanimous passage of the Atomic Energy Act of 1946 (the so-called McMahon Act) by a conservative Congress otherwise dominated by "back-to-normalcy" motivations. An enormously expensive atomic energy program, if it were sharply separated from the normal political and economic life of the nation, would not interfere with American political life; it would have as its primary domestic effect only that reduction in living standards which any other not immediately productive expenditure would have.

A systematic program to reduce vulnerability by planned decentralization and by large-scale military preparedness would, however, impinge on the daily lives of citizens in many ways. As the habit of centralized decision-making became more fixed, the problem of maintaining civilian control would become more difficult. The debate over the May-Johnson Bill and its defeat in favor of the McMahon Act is only a foretaste of the problems to come.

In one way, this new emphasis on preparedness will favor a revival of a Maginot Line type of defense philosophy. The misguided experiment in fixed defenses of which M. Maginot's name is the outstanding symbol assumed that the superiority of the defense as revealed in the machine-gun technology of World War I could be maintained. It assumed that in a world of garrison states the failure of mobile warfare could be assured. Mobile warfare may be here to stay. The offense has certainly been tending to outrun the defense in so far as military technology has influenced the outcome of military engagements. Yet the day of true *Blitzkrieg* was the day of Bismarck. Hitler almost repeated Bismarck's successes, but opposing political defenses proved in the end stronger than his initially superior military technology.

The problem of adapting society to the atomic advances in technology is the problem of finding *political* means, whether national or international, to improve the position of the defense. In the last year of the Second World War optimistic students of world politics saw the political answer to the problem of the new technology in having a revived Europe act as a buffer between two great giants. Between the two, war would be foolish because it would be protracted and indecisive. Europe has not revived in a way to have performed this function satisfactorily even in a world without atomic weapons; but, even if it had, the atomic energy inventions have largely destroyed the military function of the continent as a buffer. Its mediating buffer role in a world in which neither Soviet Russia nor the United States wants a major war remains very great, however, even in the age of atomic energy.

In a new world war there would be no cushion of time if atomic weapons were available in large numbers to both of the two giant powers. There would be no lines which would have to be held for a long time until the

1. See Ansley J. Coale, *The Problem of Reducing Vulnerability to Atomic Bombs* (Princeton: Princeton University Press, 1947).

moment for decisive action occurred. Decision in a two-way atomic war might not come early, but the most significant destruction connected with the war could come at the beginning. To reduce vulnerability to an extent which would have military significance would require that measures be completed in advance of the threat of war.

Adequate defense would not, as in the past, rest upon the resilient recuperative capacity of a productive and free but not fully prepared people. It would rest instead upon imaginative foresight in central planning and upon the fixity of purpose with which continuous preparedness is maintained in a garrison state.[2]

Purely National Action Cannot Win Security from Atomic Attack

Satisfactory adaptation to the new technology cannot be exclusively the result of national action. It is only argued that purely national action, action not dependent on the explicit voluntary agreement of any other state, can somewhat improve the American security position. It can reduce the vulnerability of the United States to atomic attack based on possession of a few bombs, prolong the period of comparative freedom from direct attack based on its present headstart, extend the period of time during which the quest for international control is able to continue and, finally, make international control work more efficiently when and if it does come.

Neither the United States nor any other power can ever win *absolute security* from atomic attack by purely national action. As the period of American monopoly draws to a close and in the succeeding period as atomic armaments behind the Iron Curtain attain politically significant proportions, security not based on Soviet-American agreement will less and less seem adequate. It is this prospect which kept alive discussions in the United Nations Atomic Energy Commission, even when they appeared hopelessly stalemated. This prospect may well cause the early revival of these discussions.

Let us examine a possible trend of events if the present impasse in control negotiations persists. The American head-start has depended largely upon the technological advantage and superior energy resource position which the United States already enjoyed. It has not depended upon the good fortune of having adequate uranium reserves under United States sovereignty. High United States productivity prior to Hiroshima instead explains American capacity to maintain access to the world's richest supplies in Canada and the Belgian Congo. Advanced technology favors a much earlier complete integration of the atomic advances into the whole technology. Thus, the American lead and the security which goes with leadership are likely for a short period to grow.

There are unfortunately likely to be forces working in the opposite direction. The extent of Soviet uranium and thorium resources are not known, nor are the extent of energy resources known which the Soviet government could allocate to atomic energy development without sacrificing some other critical element of industrial or military strength. One cannot assume on the basis of present publicly available data that Soviet resources are inadequate on either count. If they are adequate, only voluntary agreement or preventive war can stop Soviet bomb production. Possibly within a decade and probably within two decades, Soviet production of fissionable materials would reach what might be called the saturation point.

By saturation point is meant a stockpile of atomic weapons large enough to destroy the targets against which atomic weapons are peculiarly suited. The number of large cities in the world is limited and "conventional" arms can destroy lesser targets, so that the number of large-city targets governs the saturation point. At some future date, in the absence of international control, there is likely to be more than one stockpile in the world whose size exceeds the saturation requirement. The American stockpile would be larger than any other, but the American people would be unwise to derive much comfort from that fact.

The situation might be like that which Mark Twain described of the proposed duel with axes. The appetite of neither duellist for the duel was very great in a situation in which each thought both would be killed. In the less stylized form of conflict which is modern war, however, a government with no appetite whatsoever may start a conflict if its leaders feel sure that the opponent is about to start it. They may start it if they feel that the opponent has for a long time been unscrupulously trading on their own general unwillingness to start a war.

Until two-way atomic war breaks out, there is always the possibility of heading it off. Plural possession of substantial stockpiles of atomic weapons would make two-way atomic war a real possibility, but plural possession does not mean the automatic and inevitable extinction of civilization. The burden of proof, however, is on the complacent if they assert that plural possession of atomic bombs offers no real threat to the future of civilization or to the security of civilized states.[3]

There is in the interval before the American atomic monopoly finally wastes away no cause for being complacent. Science and technology will not stand still. The success of the atomic scientists has dramatized the importance and expanded the budgets of research and development programs within the armed services. One previously existing obstacle to improvement in the techniques of mass destruction has been forever removed. Any fertile suggestion for mass destruction will in an age of nationalized science be investigated because there will always be the fear that the other nation's scientists might make the discovery first. Apart from motives of patriotism which animate laboratory scientists as they do other citizens, humanitarian motives will now motivate a scientist to penetrate the realms of mass destruction if only to discover how protection may be won from the new scourge. The combined effect of expanded budget and intensified motivation will be further to accelerate the rate at which military technology is changing.

Previous armaments regulation has always presupposed a relatively stable military technology. To lay down precise obligations or to calculate the political consequences of any proposed arms regulation is almost impossible when the military technology is in violent flux. Furthermore, the nation which is bargain-

2. The first formulation of the garrison state concept is to be found in articles by H. D. Lasswell. See especially, "The Garrison State." *American Journal of Sociology*, XLVI, No. 4 (Jan. 1941) pp. 455-68. This has since been reprinted in *The Analysis of Political Behavior: An Empirical Approach* (London: Kegan, Paul, 1948) pp. 146-57.

3. See Harold C. Urey, "Atomic Energy, Aviation, and Society," *Air Affairs*, I, No. 1 (September, 1946) for a jeremiad on the consequences of plural possession. If Professor Urey's gloomy forebodings cannot be confirmed by scientific demonstration, neither can they be dismissed by any scientific demonstration that they cannot be borne out by future experience. To taunt the atomic scientists by calling them "a league of frightened men" is not only an insult to their courage and integrity but a callous exhibition of blindness. The need for important political adaptations to the atomic energy inventions is not lessened by any demonstration that a particular scientist has only a partial answer or even by a demonstration that he has a wrong answer.

ing away its atomic ace may find that in the next deal some other nation will come up with a different ace.

A world of prospective plural bomb possession, of rapidly changing military technology, and of nationalized and uninhibited science is a new world to which man will have to make a very complex adaptation and will have to make it quickly. A mass educational program will have importance to the extent that it prepares the popular mind for radical and carefully planned adaptations. As the Federation of American Scientists statement of December 9, 1947, declared:

"What is needed now is the overpowering will to agree, the all-out effort to act, not as if one nation is the enemy of another, but with the realization that all nations are partners in the desperate enterprise of living together. It is not the mechanism of the United Nations which is at fault; in this respect the substitution of any other system would not appreciably alter the situation as long as the will to agree is absent."

One would, however, be doing a disservice to the American people and to civilization in general if one interpreted this or any similar statement to mean that it is within the powers of the United States *alone* to establish world control of atomic energy. If control is to be achieved, the "overpowering will to agree" must be developed on both sides of of the Iron Curtain. This necessity is not evaded by bringing forth proposals for "limited world government." It would also be a disservice if it propagated the belief that any world government proposal, no matter how ill-conceived, would necessarily be better than any security policy based on national action, no matter how enlightened. Finally, it would be a disservice to suggest that any plan for international control which falls short of world government is necessarily worse than no control plan at all. The will to agree must be supported by an understanding of the minimum conditions which a control plan must satisfy to be acceptable.

The discussions in the United Nations Atomic Energy Commission are for the time being suspended. This was hardly due to a failure of the American people to will international control intensely enough. In 1948 increasing lack of American confidence in Soviet good faith, which is the result of a three-year Soviet-American diplomatic impasse, may not permit international agreement along the lines of the original Acheson-Lilienthal Report. However, the White House, the leadership of the armed forces, and enlightened moulders of opinion were so firmly committed to an international control plan based on an American surrender of its atomic monopoly in the year after Hiroshima that one cannot fairly attribute failure of control negotiations to a lack of public pressure to achieve control.

If control negotiations are ever to be revived, what the American government needs is discriminating pressure. It would be a great disaster if American negotiators felt that they had to produce some agreement, even if it were wholly along the lines of the Soviet proposals. American policy will fail if it is not based upon widespread understanding of the minimum conditions of international agreement, i.e., those conditions which if not satisfied would make an agreement worse than useless. What are some of these conditions?

"Middle-Run" Planning a Necessary Bridge for "Long-Run" Aims

The widely held proposition that world government must be created within x number of years is frequently confused with a totally different proposition, that it is useless to attempt to patch up the existing world political order. The transcontinental tourist with a flat tire in the mountains may be convinced that his spare will never get him to San Francisco; but he is still willing to put it on in the hope that it will get him down from the mountains to a point where he can purchase a new tire.

To put discriminating pressure on one's government requires a grasp of what may be called "middle-run" considerations. Belief in the long-run adequacy of this or that proposed line of action provides no basis for rejecting "middle-run" or short-run proposals for action. Overconcentration on long-run considerations may result in such complete lack of regard for questions of feasibility as to promote the war which an "adequate" long-run solution seeks to avoid. Modern civilization can after all only be destroyed once. If it is destroyed because methods of getting along peacefully through the next generation on the basis of voluntary agreement are rejected, the adequacy of a solution which if it had been adopted would then have given absolute security would be irrelevant.

Overconcentration on long-run considerations also ignores the beneficent possibilities which might follow the adoption of a number of ameliorating "inadequate" policies. Taken together, their effect might create a new burst of confidence in man's capacity to deal rationally with atomic energy, a new will to achieve effective control, and a new framework within which control could be negotiated.

An opposite evil is overconcentration on the short run. Those who would have maximum present security in exchange for a future of assured insecurity exhibit this defect in their thinking. Another manifestation of overconcentration on the short run is the restless search for the tactics which will break the present diplomatic log jam. Taken in conjunction with a middle and a long-run plan of action, the search for the one correct immediate tactic has relevance, although even in this case the professional diplomat is likely to have a better grasp of tactics than an outsider. But by itself a proposal of an immediate tactic as if it were a complete solution deserves short shrift.

An illustration is the frequently heard proposal for a personal conference between the President of the United States and Marshal Stalin. Another is the suggestion that each of these two gentlemen be given access to the nation-wide broadcasting systems of the other nation. Neither tactics can be judged apart from the steps which would have to follow. Mr. Truman would, for example, have to make a statement to Mr. Stalin or to the Soviet people. For him to make such a statement he would have to have a program of action to present as a basis for negotiation. This program would involve considerations of policy over the next few years, and it is the program of action rather than the proposal for a Truman-Stalin meeting which requires public discussion to provide enlightened and discriminating support to the government.

This brings us to the question of the middle-run considerations which in fact govern the direction of great-power policy, including United States policy on atomic energy control. What can in fact be done, short of setting up a true world government, which if done will make it easier to

solve the remaining unsolved questions? If one can define this sphere of action, he can state what parts of the control problem are negotiable separately from the creation of a world authority with coercive power of its own such that it can coerce great states and small states and coerce them with equal effectiveness.

From the American point of view an international control plan which is not rascal-proof would be worse than no plan. Our present insecurity, in which we know we have bombs but are not sure when the other fellow will have them, would be as nothing to the insecurity of a people who had given up their bombs only to discover that the other fellow has secretly and illegally come into possession of some. The essential and therefore minimum separable portion of a total control plan would be one that gave in sufficient time reliable knowledge that no country was manufacturing or stockpiling significant quantities of illicit fissonable materials. The qualification "in sufficient time" means that knowledge must come in time for preponderant force to be organized against the violator.

The corrollary which one segment of military thinking drew from this proposition about minimum control is as follows:

"We appreciate that the most we can expect from a system of international atomic control is a period of approximately one year in which to prepare for a full-scale atomic attack with significant quantities of bombs after warning has been given of a major violation of international control regulations on the part of one nation or a group of nations; therefore, we must retain indefinitely, in accord with international agreements, our knowledge and industrial capacity to produce atomic weapons."[4]

The War Department point of view just expressed is ambiguous as to whether any other country is to be permitted "knowledge and capacity to produce atomic weapons" in exchange for its promise not to produce them. We must assume, however, that any voluntary agreement to limit or prohibit the production of atomic weapons must put the United States and the Soviet Union on the plane of full equality in this matter.

How can the requirements of a reliable warning system and full equality between the Big Two be met? One recent development may make this task politically less difficult. So long as cheap and abundant power from atomic energy appeared an imminent possibility, there seemed no way to avoid large-scale plutonium production in peacetime. But to have permitted production of militarily significant quantities of fissionable materials would have required international agreements on quantities and ratios of permitted production.

Fortunately, the imminent peacetime applications of atomic energy in the field of isotope research do not require militarily significant amounts of fission products. The way is thus paved for preservation of strategic balance (including equality between the Big Two) on the basis of all nations surrendering their right to produce militarily significant amounts. This is the so-called "0-0-0" (zero-zero-zero) proposal.[5] So long as atomic energy remains unavailable as an efficient power source, the cost in terms of peacetime benefits of agreeing to shut down large-scale production of fissionable materials everywhere in the world would be nil even for the United States with its huge investments at Oak Ridge and Hanford.

One final word is perhaps necessary as to what an initial control agreement should not contain. The changed emphasis on national policy from mobilization after the crisis to preparedness before the crisis reduces the value of a token international police force in enforcing any violation of an atomic energy control agreement. No other kind of international police force is today at all probable. Deterrent action and enforcement action will therefore have to be primarily national action. It is of great importance that this not be hampered by any requirement that it wait upon the exhaustion of the labyrinthine procedures of the United Nations. What is needed at the international level as a practical first step is a reliable fire-alarm system. The members of the present volunteer fire department must not be kept away from the scene of the fire because a professional group of firefighters may some day be organized.

A convenient way of summarizing this analysis is to restate the ways in which prevailing beliefs about the necessary social adaptation to atomic energy developments have become clearer in the thirty months of active discussion.

Summary of Analysis

1 The need for planned and rapid adaptation of world political organization in the atomic era is apparent, as it has been from the first public announcement of the bombing of Hiroshima; but it is now more widely believed that the first step may have to be taken before the last step is clearly seen.

2 Soviet-American will to collaborate was assumed to exist in the field of atomic energy control in 1945 as it was in every other field. In 1948 it is recognized that agreement depends on developing the Soviet will to agree at least as much as the American.

3 The limitation of atomic weapons as instruments of policy are more clearly seen in 1948 than 1945. Preventive war if possible looks less attractive now than then and the utility of atomic weapons to achieve atomic energy control may be doubted.

4 A world with no international authority to control atomic energy seemed the worst possible prospect in 1945. In 1948 it is recognized that an effective control plan would be worse.

5 In 1945 there was a tendency to assume that definitive solutions could be found within a relatively short time. Now there is a wider expectation of prolonged impasse and continuing irritable Soviet-American relations.

6 In 1945 the possibility of any very effective national action to make a world of no-control tolerable was heavily discounted. Now it is being re-examined.

7 The first step toward international control is seen to be a very big step, a rascal-proof inspection plan; but the internationalization of enforcement action must follow at a later date. This first step would not banish war, but it might make it possible for the war to be concluded before atomic destruction had been wrought on all the great cities of all the participants.

8 Neither total war nor total peace is inevitable, nor does this exhaust the range of possibilities. There is a third possible eventuality, protracted bad relations, ultimately perhaps followed by slow improvement.

4. "The Effects of the Atomic Bomb on National Security (An Expression of War Department Thinking)," *Army and Navy Journal*, April 12, 1947; reprinted as "War Department Thinking," *Bulletin of Atomic Scientists*, Vol. III, No. 6 (June, 1947), pp. 150 ff.

5. See, e.g., proposed by D. F. Cavers, *Bulletin of Atomic Scientists*, Vol. 3, No. 10 (October, 1947), p. 283. Also C. Daniel and A. M. Squires, *Op. Cit.*, Vol 3, No 4 and 5, p. 111.

THE MEDICAL PROGRAM OF THE ATOMIC ENERGY COMMISSION

Shields Warren

The following is a condensed version of an address given before the American Medical Association's Isotopes Symposium in Chicago on June 22. Dr. Warren is the Director of the Division of Biology and Medicine of the Atomic Energy Commission.

The last six years have seen the initiation of more profound changes in scientific medicine than any period since the discovery of bacteria or the invention of the microscope. This change has been brought about by many factors: the wholesale uprooting incident to the war, the development of antibiotics, the impact of social legislation, but above all the advent of atomic energy. When we consider that before the war, scattered individuals received localized radiation in the hospitals and in doctors' offices whereas hundreds of thousands were killed or exposed to ionizing radiations at Hiroshima and Nagasaki; when we think that six years ago the average man had no more concern with ionizing radiation than as a means of checking on an aching tooth or determining the cause of chronic cough, whereas today millions of people live within the shadow of possible war-time exposure to ionizing radiation from the atomic bomb; when we realize that six years ago it would be a skilled chemist who could detect after hours of work a millionth of a gram of phosphorus and now a technician with a Geiger counter can detect a fraction of a millionth of a gram of radioisotopic phosphorus in a few minutes, we can realize how long a road we have come in this short span.

As a result of the atomic bomb in Japan, the Bikini test and the lowering clouds of war, it is natural that we think of atomic energy in terms of mass destruction, mass destruction cheaper and more efficient than any other than envisaged. However, like the old coin with the eagle and clutched arrows on one side and the head of Liberty on the other, this picture of atomic energy has a fair and forward looking obverse. What atomic energy may bring about in the way of development of power and of heat, what it may do in the propulsion of ships or aircraft remains all but hidden in the mists of the future. What it means as a provider of research tools is at present as overwhelming as a streamliner rushing down upon a grade crossing.

In any consideration of radiation it is important to remember that ionizing radiation may effect the body in two ways, first as external radiation, as from the conventional X-ray tube, and second, as internal radiation as from the administration of radioactive phosphorus.

The various ionizing radiations affect cells qualitatively in similar fashion. There is no way that one can tell by examination of a cell or tissue whether the radiation effect seen has been produced by neutrons, by 200 KV X-ray or by the gamma rays of radium. The predominating effect is assumed to be through interference with the nucleic acid metabolism of the cell. External radiation in passing through the body has an almost equal chance of being absorbed by the various cells with which it comes in contact. The quantitative variation that these cells show in response hinges chiefly on their inherent sensitivity to irradiation. In internal radiation, on the other hand, because of the specific affinity of certain tissues for specific elements, as, for example, bone and phosphorus, or thyroid and iodine, and because of the relatively short range of many of the types of radiation emitted by the various isotopes, there can be some degree of selective localized radiation.

Radioactive isotope therapy attempts to take advantage of these selective localizations. In determining the therapeutic value of any radioactive isotope there are several factors to be taken into consideration: first, the inherent toxicity of the substance itself; thus, strontium, which might be useful because of its high toxicity to bone marrow. Second, the half-life of the material: material which has a long half-life is much more dangerous from the standpoint of possible excessive radiation than one with short. On the other hand, problems of shipment and preparation of the material for administration demand a certain amount of time, and material with too short half-life would not be satisfactory. Third, the degree of localization, for example: radioactive sodium is relatively limited in use because of the very high degree of diffusibility of the sodium ion. Fourth, range and type of radiation which tends to limit the region effectively irradiated to the vicinity of localization. Fifth, the element must be such that its specific activity can be reasonably high, preferably in the order of one millicurie per milligram of element. Thus, radioactive calcium with a half-life of 45 days might be a fairly suitable material from the therapeutic standpoint; however, the specific activity of calcium is relatively low and consequently, it is difficult to get an effective concentration of the isotope at a desired point. There are relatively few substances that fulfill all these desirable criteria.

There is also an important set of variables from the standpoint of the lesion to be treated. First, the lesion must be one that may be satisfactorily treated by ionizing radiation, that is, its cells must be responsive to radiation; second, there must be a fair differential between the sensitivity of the abnormal and the normal cell of the part.

In the light of these limitations, it is not surprising that only a few isotopes among those thus far tried have been useful from the standpoint of therapy. These are radioactive phosphorus in the case of polycythemia vera, and some leukemias;

iodine$_{131}$ in rare carcinomas of the thyroid and gold$_{189}$ in some malignant processes where either direct injection into the tumor is utilized or the selective uptake of colloidal substance by the reticuloendothelium system is of value.

The medical program of the Atomic Energy Commission may be divided into four parts. First, the maintenance of health of the workers of the Commission and its contractors. Thus far, the health and safety record is an enviable one, and speaks highly for the foresight of those who set the initial standards of safety and permissible dose levels for exposure to ionizing radiation. Second, the protection of environmental health. This involves such problems as waste disposal, possible contamination of surrounding areas and the like. Third, the development of basic research in those problems peculiarly related to atomic energy, of which the effect of ionizing radiation on the plant, animal and human cell, both isolated and aggregated into organisms, must be determined. Such problems as permissible dose levels of ionizing radiation, metabolism of new or rare elements, the mechanism of radiation injury, the development of therapy for such injury, the character and mode of development of hereditary changes due to ionizing radiation are among those of basic importance. Fourth, the exploration of what, if any, values the new sources of energy available at the installations of the Atomic Energy Commission themselves and the value that very short-lived radioactive isotopes may have in cancer research and cancer therapy.

An important aspect of the cancer research program is the provision free of the isotopes thus far established as most definitely of value, namely phosphorus$_{32}$, iodine$_{131}$, and sodium$_{24}$, for cancer research and cancer therapy. It is hoped that this list may later be enlarged to cover other important materials. Cobalt$_{60}$ is receiving very careful consideration at the present time. It is of special interest, owing to the fact that the gamma radiations from cobalt are essentially the same as those from radium since cobalt has a moderately long half-life of 5.3 years, and since it is nontoxic as an element its use offers certain definite advantages. Of particular importance is the fact that it is not an alpha particle emitter and is not stored indefinitely in bone as in the case of radium and radon.

Finally, since no program can hope to be better than the personnel by which it is being implemented, training plays a very important part. The training program, administered by the National Research Council for the Atomic Energy Commission, provides up to 100 predoctoral fellowships annually and 75 postdoctoral fellowships annually in the life sciences.

The greatest latitude compatible with sound training will be offered the fellow in obtaining his training, whether in the installations of the Atomic Energy Commission or whether in a university or a hospital. One feature of the predoctoral fellowships is their availability to medical students who may desire to interrupt their training, particularly at the end of the second year, for a year of fundamental research in this new field.

Atomic Energy and the National Party Platforms

One of the most interesting contrasts of the election year occurred when the Republican Party omitted mention of the international control of atomic energy from its platform while the Democratic platform specifically favored it. Reported in the *New York Herald Tribune* on June 23 as being a concession to the isolationist sector of the Republican Party, the omission was also reported by the *New York Times* on the same day as being one of two victories won by Senator C. Wayland Brooks of Illinois.*

In response to a Bulletin inquiry this omission was explained as follows by Senator Henry Cabot Lodge, Jr., in a letter dated July 15:

"Let me say at the outset that this question never came before the Convention at all. It did arise for a very brief instant before the Resolutions Committee and I shall gladly tell you all that I know on this subject....

"The Resolutions Committee, as perhaps you know, consisted of 104 men and women from the 48 states and territories. In the space of three days, this committee, most of the members of which had never seen each other before, were required to conduct hearings for a large number of witnesses who desired to be heard on a wide variety of public questions and then adopt a document known as a platform. At these hearings no testimony was received from any source on the matter of international control of atomic energy. It did, I think, find its way into one of our working papers and I believe that I was instrumental in inserting it. There were, of course, many working papers, some of which contained this language and some of which didn't. Evidently one copy of one of these working papers was obtained by a member of the press and, being in the nature of "a scoop," it was given much newspaper attention—more, I believe, than its importance warranted because it had no official character at all and was merely a work sheet.

"Later, in the full committee, one member moved to take out this reference, not, as I recall, because of any substantive or intrinsic objection to it, but solely on the grounds that no testimony had been taken on it and that in the brief time at our disposal it would be impossible for us to discover exactly what all its meanings and implications were. It must be remembered that a resolutions committee, unlike a committee of Congress, not only has very little time, but has no power to call experts and make a thorough investigation. The adoption of the motion to strike out the words "international control of atomic energy," therefore, was not in any sense a vote on the merits or demerits of the question. It was simply an admission of the fact that the committee did not want to discuss any more topics than were actually at issue and was unwilling to venture into fields in which it had had and could have no opportunity to inform itself."

It was widely reported that Senator Arthur H. Vandenberg, chairman of the Senate Foreign Relations committee, had been responsible for the entire Republican foreign policy plank in its original form including the specific mention of atomic energy control.

The Democratic platform contains three specific recommendations on atomic energy: 1. The International control of atomic energy; 2. Continued civilian control in this country; 3. The continued non-partisan administration of the Atomic Energy Commission. International control of atomic energy was urged by Senator McMahon in a speech before the Democratic Convention on July 13.

*The other concession: omission of assurance that appropriations would be forthcoming to implement commitments for the European Recovery Program contained in previous legislation.

IN MEMORIAM: JOYCE CLENNAM STEARNS

Joyce Clennam Stearns died at his home in Webster Groves, Missouri, on June 11. He had served as Director of the "Metallurgical" Laboratory at the University of Chicago during the last year of the war, and since July, 1945, had been Dean of the Faculties of Washington University in St. Louis.

Stearns was born in Meadville, Missouri in 1893, studied Liberal Arts at Kingfisher College, took his Master's and Doctor's degrees in physics at the University of Chicago, and taught successively at Albion College and the University of Denver, where he was professor and eventually chairman of the department of physics. He was among the first to be drawn to Chicago in January, 1942, when the atomic program was set up as an active war project. Here his work was concerned chiefly with employment of personnel, with the training of new men in the new field of atomic science, and later with maintaining the strength of the laboratory at the crucial stage of the preparation of the bombs, when the heaviest demands were being made upon it for trained men to work at Los Alamos and Hanford, and high pressure work had still to be done at the home base.

The climax of his professional career was at Washington University, where as Dean of the Faculties Joyce Stearns was the guiding spirit in rebuilding the staff after the disruption of the war. If the students and faculty of this University have the courage and the forward look that comes with growing strength, it is to a large extent because of the respect for scholarship, for firm justice, and for practical human values which he brought with him.

Stearns made notable contributions in his special field of science, as a distinguished educator, and as an able administrator. His first major scientific work was a classic demonstration that magnetization of iron makes no considerable change in the positions of the atoms or the electrons of which the iron is composed. This result ruled out the older theory of magnetism, based upon the Bahr atom, according to which the electrons revolving in orbits constituted the elementary magnets that were oriented by the applied magnetic field. It was consistent however with the later theories according to which the electrons are themselves magnets that become oriented when the iron is magnetized. Stearns' experiment consisted of magnetizing a crystal of iron from which a beam of X-rays was reflected. He found that no change in the strength of the reflected beam as great as one part per thousand was caused by magnetization, whereas changes of several per cent should have been expected if the orbits in which the electrons revolved had followed the magnetic field.

Stearns also carried on several interesting experiments with cosmic rays, including tests of possible directional effects from the sun, and of east-west asymmetry of cosmic ray showers. His most notable achievement in cosmic ray studies, however, was his establishment of the high altitude laboratory on Mt. Evans, just west of Denver. Stearns secured the cooperation of the Denver City Parks in building a road to the top of the mountain, and in preparing the site for the laboratory. He persuaded the University of Denver, Massachusetts Institute of Technology, and the University of Chicago to cooperate with Mr. John Evans in building and maintaining the laboratory. He gave valuable aid to the many expeditions to Mt. Evans from several universities by offering his own laboratory at Denver as a low altitude base of operataions, and by helping with the experiments in many ways. It would be a fitting tribute, indeed, to name the Mt. Evans laboratory after him.

Few physicists have earned as high a reputation in the field of teaching. His work at Denver was chiefly with undergraduates. But many graduate schools learned to look to Stearns for sending them well-trained students with live interest in their science.

At the Metallurgical Laboratory, Stearns was one of the invaluable men who without consideration of their own personal interests would put their full effort on the tasks that needed most to be done. Thus he served successively as director of personnel, director of the physics division, and director of the Laboratory. His understanding of human nature, his keen sense of humor and his forthright honesty made him one whom all respected. One of his most notable services was organizing and carrying through the training program for the engineers who were to build and operate the Hanford plant that would use the atomic chain reaction for producing plutonium. Mature men had to learn a new art and science from their not always too patient juniors. The skill with which these engineers later met their difficult assignments spoke eloquently for the effectiveness of their training.

At Washington University the teaching staff of most of the schools had been dispersed during the war. In certain of the schools the faculty had in fact almost ceased to exist. With the help of those who remained, Stearns had the task of reorganizing effective groups of teachers to meet the rush of postwar students. He brought with him not only a familiarity with educational problems, but also administrative experience and a remarkable ability to get things done. He undertook this extraordinarily difficult assignment because he saw the urgent need to develop in this central area of the nation a powerful agency for giving education that would help in bringing lasting peace. He had the satisfaction of seeing a good growth in the direction of his efforts and of feeling a warmth of friendship from his colleagues such as is rarely experienced.

—ARTHUR H. COMPTON

The BULLETIN OF THE ATOMIC SCIENTISTS has a special reason to mourn the loss of Joyce C. Stearns. From the inception of the discussions among scientists on the atomic bomb project about the political and military implications of the bomb discovery, Stearns took a lively and sympathetic interest in them. He was one of the older and more mature scientists who shared, not only the concern of the younger scientists about the impact of atomic energy on society, but also the urge to "do something about it". In June, 1945 he participated in the preparation of the Report to the Secretary of War (reprinted in the BULLETIN in May, 1946), which discussed the advisability of the use of the atomic bomb in the war with Japan, and pressed for international arrangements for elimination of atomic weapons. Later he took part in the fight for civilian control of atomic energy. In the last two years of his life, his heavy responsibilities at the Washington University and his failing health did not permit him to continue these activities; but those who carried on knew that he was still with them.

—The Editors

BRITISH ATOMIC SCIENTISTS' STATEMENT ON INTERNATIONAL CONTROL OF ATOMIC ENERGY

The following statement was issued by the Council of the British Atomic Scientists Association, July, 1948.

1. The Atomic Scientists' Association since its foundation in 1946 has pressed for International Control of Atomic Energy. It has become obvious in recent months that this is unlikely to be achieved in the near future and in view of the recent proposals by the British, French and U.S. Governments to adjourn the Atomic Energy Commission of the United Nations Organization, it is clear that the attempt to achieve it has for the time being failed. A restatement of the position of the Association in this matter is therefore necessary.

2. In 1946, when the work of the Association began, it seemed that the existence of machinery for the control of atomic energy could do much to lessen suspicion and decrease the dangers of war, and also that the recent invention of atomic weapons could be used to induce the powers to set up such a scheme. The reasons for this belief were the following:

(a) The destruction in the cities of all belligerents which the strategic use of atomic bombs would entail, and the difficulty of envisaging a satisfactory system of defense, provided obvious incentives to the setting up of a control scheme.

(b) The technical possibility of the control of atomic energy, as described in the Lilienthal report, was widely held to make it a suitable subject for a first exercise in the control of armaments.

3. It is now clearer than it was in 1946 that the sources of disagreement between the major powers are so deep that the institution and working of a control scheme would be much more difficult than at first supposed. As a result there does not appear to be any chance of agreement at the moment either on the lines of the Lilienthal proposals or on any more limited scheme. The reasons for this disagreement can perhaps be summed up as follows: The United States Government would be unwilling to abandon its lead in atomic weapons without a complete system of inspection and control which would ensure that no other country was building up these armaments to use against America. The U.S.S.R., on the other hand, believes that in any control authority acceptable to the Americans the countries voting for Russia would be a minority, and that the development of atomic energy in their country would pass under foreign direction, with resultant foreign influence on their whole economy. In addition, their attitude may be influenced by the view that any complete scheme of inspection would give the outside world information of strategic value about the location of their industry.

4. The Council of the Association wishes to put on record its continuing belief in some form of International Control of Atomic Energy as the most desirable ultimate solution of the problem of atomic weapons; it does not, however, consider that any good purpose will be served by pressing for it now. A substantial change in international relations is necessary before such plans—in a form which will have to depend on the international situation at the time—can be revived with any hope of success; it is possible they will then be linked with proposals for limitation of other weapons, and, in a changed situation, some benefit might perhaps be expected even from a scheme less complete than the Lilienthal proposals.

5. Certain other solutions have been put forward from time to time. One of these is that a moratorium should be established in the development of atomic energy, so that the nations of the world would agree to build no large scale plants capable of producing fissile materials. This would not only stop work on essential power production, but would be meaningless unless it included the closing-down of American production plants and disposal of stocks of fissile material. This would not be acceptable to the Americans without the same safeguards* as have been proposed in the control scheme. Such a scheme would still involve the problem of inspection to ascertain the absence of undeclared installations, and this, rather than the inspection of declared plants, seems to lead to most serious disagreement. For those reasons, the Council does not believe that a moratorium offers any hope of easing the problem.

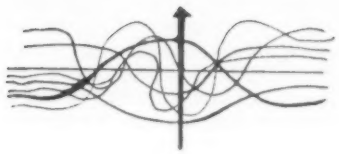
6. Another suggestion that has been made is that a control scheme should be set up, which did not include all nations, but to which all nations willing to do so could belong. We believe that this proposal misses the point of the original plans for international control. These were designed to promote agreement and remove suspicion between nations which might otherwise be hostile. One important feature of the control schemes was that once a system of safeguards had been set up, there would no longer be any need for secrecy in scientific and technical matters, and this would make an important contribution towards removing mutual suspicion. It is certain that in a scheme which did not include at least all major powers secrecy would be retained. Schemes for closer collaboration between some nations, for example, between Western Europe and the United States, might, of course, be desirable because of their advantages in the economic and military spheres, but they should not be regarded as a step towards the international control of atomic weapons.

7. The Council, seeing no hope of an early agreement regarding the atomic bomb and other weapons of mass destruction, believes that the solution can now be sought only through the constant promotion of all measures designed to make war less likely, and to reach a settlement between East and West. In particular, it does not believe that any solution tolerable to the peoples of this country and of Western Europe could be obtained through the dominance of one side over the other. It does not believe that through the development of atomic weapons alone any nation is likely to be able to secure quick victory over a great power with widely dispersed industries; any conflict would be a long and costly struggle, in which Western Europe is likely to be a battlefield and in that case would suffer serious devastation.

8. The Council of the Atomic Scientists' Association also wishes to reaffirm its belief that collaboration between scientists of different nations is of value both in the interests of science itself and as a contribution towards international understanding. In particular, in view of recent political developments, we believe it important to maintain and improve contacts between the scientists of countries in the East of Europe and those of Western Europe and America.

* The authors of this plan argue that the safeguards, although needed, will be less stringent and difficult to implement than in the case of unrestricted production.

THE ATOMIC BOMB AND PEACE WITH RUSSIA



Henry L. Stimson

In this chapter of his memoirs "On Active Service in Peace and War," Mr. Stimson reveals the development of his thinking about the atomic bomb and its effect on our relations with Russia, both during his tenure as Secretary of War and after his retirement. Written in collaboration with McGeorge Bundy, the book has recently been published by Harper and Brothers, by whose kind permission this chapter is reprinted.

The first reaction of the American people to the advent of atomic energy was a great feeling of pride and satisfaction in a colossal wartime achievement. The bomb which exploded over Hiroshima made it clear that the victory was at hand. But this reaction was quickly succeeded by the others relating to the disquieting future. As Stimson put it on August 9:

"Great events have happened. The world is changed and it is time for sober thought. It is natural that we should take satisfaction in the achievement of our science, our industry, and our Army in creating the atomic bomb, but any satisfaction we may feel must be overshadowed by deeper emotions.

"The result of the bomb is so terrific that the responsibility of its possession and its use must weigh heavily on our minds and on our hearts. We believe that its use will save the lives of American soldiers and bring more quickly to an end the horror of this war which the Japanese leaders deliberately started. Therefore, the bomb is being used.

"No American can contemplate what Mr. Churchill has referred to as 'This terrible means of maintaining the rule of law in the world' without a determination that after this war is over this great force shall be used for the welfare and not the destruction of mankind."

This statement was the public expression of thoughts which had been for many months heavily on the minds of those familiar with the atomic project. When Stimson went to the White House on April 25, 1945, to discuss the atomic bomb with a President from whom the matter had hitherto been kept secret, he took with him a memorandum which dealt not so much with the military use of the bomb as with its long-range political meaning.

MEMORANDUM DISCUSSED WITH THE PRESIDENT
April 25, 1945:

"1. Within four months we shall in all probability have completed the most terrible weapon ever known in human history, one bomb of which could destroy a whole city.

"2. Although we have shared its development with the U.K., physically the U.S. is at present in the position of controlling the resources with which to construct and use it and no other nation could reach this position for some years.

"3. Nevertheless it is practically certain that we could not remain in this position indefinitely.

"a. Various segments of its discovery and production are widely known among many scientists in many countries, although few scientists are now acquainted with the whole process which we have developed.

"b. Although its construction under present methods requires great scientific and industrial effort and raw materials, which are temporarily mainly within the possession and knowledge of U.S. and U.K., it is extremely probable that the future will make it possible to be constructed by smaller nations or even groups, or at least by a large nation in a much shorter time.

"4. As a result, it is indicated that the future may see a time when such a weapon may be constructed in secret and used suddenly and effectively with devastating power by a willful nation or group against an unsuspecting nation or group of much greater size and material power. With its aid even a very powerful unsuspecting nation might be conquered within a very few days by a very much smaller one. . . .

"5. The world in its present state of moral advancement compared with its technical development would be eventually at the mercy of such a weapon. In other words, modern civilization might be completely destroyed.

"6. To approach any world peace organization of any pattern now likely to be considered, without an appreciation by the leaders of our country of the power of this new weapon, would seem to be unrealistic. No system of control heretofore considered would be adequate to control this menace. Both inside any particular country and between the nations of the world, the control of this weapon will undoubtedly be a matter of the greatest difficulty and would involve such thoroughgoing rights of inspection and internal controls as we have never heretofore contemplated.

"7. Furthermore, in the light of our present position with reference to the question of sharing it with other nations and, if so shared, upon what terms, becomes a primary question of our foreign relations. Also our leadership in the war and in the development of this weapon has placed a certain moral responsibility upon us which we cannot shirk without very serious responsibility for any disaster to civilization which it would further.

"8. On the other hand, if the problem of the proper use of this weapon can be solved, we would have the opportunity to bring the world into a pattern in which the peace of the world and our civilization can be saved. . . ."

And it was already apparent that the critical questions in American policy toward atomic energy would be directly connected with Soviet Russia. Whatever might be the complications of domestic atomic policy, and whatever difficulties might arise in negotiations with noncommunist Allied nations, it seemed reasonable to believe that the overwhelming menace of uncontrolled atomic power would in these areas compel satisfactory agreement and effective controls. But in the case of Russia matters were wholly different. There was no assurance that the Russians would hasten to agree on controls, nor could any agreement including Russia be regarded with any great confidence unless it contained such far-reaching rights of inspection as to counterbalance (and perhaps, in Russian eyes, to undermine) the protective and fearsome secrecy of a police state.

Diplomacy Dominated by Efforts to Involve Russia with Japan

Even the immediate tactical discussion about the bomb involved the Russians. Much of the policy of the United States toward Russia, from Teheran to Potsdam, was dominated by the eagerness of the Americans to secure a firm Russian commitment to enter the Pacific war. Stimson himself had always hoped that the Russians would come into the Japanese war, but he had had no part in the negotiations by which Franklin Roosevelt tried to insure this result, and in June, 1945, he was disturbed to find that a part of the Russian price was a Soviet lease of Port Arthur and Soviet participation with the Chinese in the control of the Manchurian railways. This agreement was accompanied by a Russian promise to leave the Chinese in full control of Manchuria, but in the light of the Polish situation Russian promises of this character no longer seemed reliable. Such an agreement was perhaps better than nothing but it would be an irony indeed if a new Manchurian crisis should one day develop because of arrangements made during a war whose origins were in that very area.

The news from Alamogordo, arriving at Potsdam on July 16, made it clear to the Americans that further diplomatic efforts to bring the Russians into the Pacific war were largely pointless. The bomb as a merely probable weapon had seemed a weak reed on which to rely, but the bomb as a colossal reality was very different. The Russians may well have been disturbed to find that President Truman was rather losing his interest in knowing the exact date on which they would come into the war.

Russian Behavior at Potsdam Was Deeply Disturbing

The Russians at Potsdam were not acting in a manner calculated to increase the confidence of the Americans or the British in their future intentions. Stalin expressed a vigorous and disturbing interest in securing bases in the Mediterranean and other areas wholly outside the sphere of normal Russian national interest, while Russian insistence on *de facto* control of Central Europe hardly squared with the principles of the Atlantic Charter to which the Russians had so firmly announced their adherence in early 1942. These extravagant demands were backed by the Red Army, which was daily increasing in its relative strength in Europe, as the Americans began their redeployment for the Pacific attack. Naturally, therefore, news of the atomic bomb was received in Potsdam with great and unconcealed satisfaction by Anglo-American leaders. At first blush it appeared to give democratic diplomacy a badly needed "equalizer."

Stimson personally was deeply disturbed, at Potsdam, by his first direct observation of the Russian police state in action. The courtesy and hospitality of the Russians was unfailing, but there was evident nonetheless, palpable and omnipresent, the atmosphere of dictatorial repression. Nothing in his previous life matched this experience, and it was not particularly heartening to know that the Soviet machine for the time being was operating to insure the comfort and safety of the Allied visitors. Partly at firsthand and partly through the reports of Army officers who had observed the Russians closely during the first months of the occupation, Stimson now saw clearly the massive brutality of the Soviet system and the total suppression of freedom inflicted by the Russian leaders first on their own people and then on those whose lands they occupied. The worlds "police state" acquired for him a direct and terrible meaning. What manner of men were these with whom to build a peace in the atomic age?

For the problem of lasting peace remained the central question. Any "equalizing" value of the atomic bomb could only be of short-range and limited value, however natural it might be for democratic leaders to be cheered and heartened by the knowledge of their present possession of this final arbiter of force. As Stimson well knew, this advantage was temporary.

But could atomic energy be controlled, he asked himself, if one of the partners in control was a state dictatorially and repressively governed by a single inscrutable character? Could there be *any* settlement of lasting value with the Soviet Russia of Stalin? With these questions and others crowding his mind, he wrote in Potsdam for the President a paper headed, "Reflections on the Basic Problems Which Confront Us." It was a tentative and, as he later thought, an incomplete piece of work, presenting only one side of a many-sided question. But it was all right as far as it went.

Stimson Analyzes Relations with a Police State

The central concern of this paper was the Russian police state, and only secondly the atomic bomb. Stimson's first main point was that the present state of Russia, if continued without change would very possibly in the end produce a war.

"1. With each international conference that passes and, in fact, with each month that passes between conferences, it becomes clearer that the great basic problem of the future is the stability of the relations of the Western democracies with Russia.

"2. With each such time that passes it also becomes clear that that problem arises out of the fundamental differences between a nation of free thought, free speech, free elections, in fact, a really free people, [and] a nation which is not basically free but which is systematically controlled from above by secret police and in which free speech is not permitted.

"3. It also becomes clear that no permanently safe international relations can be established between two such fundamentally different national

systems. With the best of efforts we cannot understand each other. Furthermore, in an autocratically controlled system, policy cannot be permanent. It is tied up with the life of one man. Even if a measure of mental accord is established with one head the resulting agreement is liable to be succeeded by an entirely different policy coming from a different successor.

"4. Daily we find our best efforts for co-ordination and sympathetic understanding with Russia thwarted by the suspicion which basically and necessarily must exist in any controlled organization of men.

"5. Thus every effort we make at permanent organization of such a world composed of two such radically different systems is subject to frustration by misunderstandings arising out of mutual suspicion.

"6. The great problem ahead is how to deal with this basic difference which exists as a flaw in our desired accord. I believe we must not accept the present situation as permanent for the result will then almost inevitably be a new war and the destruction of our civilization."

It was easier to state the problem and insist that it be solved than to suggest any course likely to be effective. Stimson found some hope in the brave words of the Soviet Constitution of 1936. They were an indication that Stalin knew at least what freedom *ought* to mean. But they did not suggest any clear answer to the questions he then posed. "(a) When can we take any steps without doing more harm than good? (b) By what means can we proceed? (1) by private diplomatic discussion of the reasons for our distrust? (2) by encouraging open public discussions? (3) by setting conditions for any concessions which Russia may ask in respect to territorial concessions, loans, bases, or any other concessions?

"How far these conditions can extend is a serious problem. At the start it may be possible to effect only some amelioration of the local results of Russia's secret police state."

Russian Attitude toward Individual Liberty Is a Stumbling Block

All these aspects of the Russian problem paled in meaning before the question of Russia and atomic energy. And in the last paragraph of his Potsdam reflections Stimson came to a gloomy conclusion.

"7. The foregoing has a vital bearing upon the control of the vast and revolutionary discovery of X [atomic energy] which is now confronting us. Upon the successful control of that energy depends the future successful development or destruction of the modern civilized world. The committee appointed by the War Department which has been considering that control has pointed this out in no uncertain terms and has called for an international organization for that purpose. After careful reflection I am of the belief that no world organization containing as one of its dominant members a nation whose people are not possessed of free speech, but whose government action is controlled by the autocratic machinery of a secret political police, can give effective control of this new agency with its devastating possibilities.

"I therefore believe that before we share our new discovery with Russia we should consider carefully whether we can do so safely under any system of control until Russia puts into effective action the proposed constitution which I have mentioned. If this is a necessary condition, we must go slowly in any disclosures or agreeing to any Russian participation whatsoever and constantly explore the question how our headstart in X and the Russian desire to participate can be used to bring us nearer to the removal of the basic difficulties which I have emphasized."

Is the Problem the Atom or Russia?

Returning from Potsdam Stimson found himself nearing the limits of his strength, and after two weeks made crowded by the atomic attacks and their announcement, followed by the surrender negotiations, he retreated from Washington for three weeks of rest. In the quiet of the Adirondacks he thought again about the atom and Russia. Twice McCloy came from Washington to talk with him, and at the other end of the secret telephone were Harrison and Bundy; the War Department civilian staff was thinking long and painful thoughts about the atomic triumph.

Stimson was worried. Granting all that could be said about the wickedness of Russia, was it not perhaps true that the atom itself, not the Russians, was the central problem? Could civilization survive with atomic energy uncontrolled? And was it practical to hope that the atomic "secret"—so fragile and short-lived —could be used to win concessions from the Russian leaders as to their cherished, if frightful, police state? A long talk with Ambassador Harriman persuaded Stimson that such a hope was unfounded; the Russians, said Harriman, would regard any American effort to bargain for freedom in Russia as a plainly hostile move. Might it not then be better to reverse the process, to meet Russian suspicion with American candor, to discuss the bomb directly with them and try to reach agreement on control? Might not trust beget trust; as Russian confidence was earned, might not the repressive—and aggressive—tendencies of Stalinism be abated? As he pondered these questions—and above all as he pondered a world of atomic competition— Stimson modified his earlier opinion and on September 11 he sent to the President a memorandum urging immediate and direct negotiations with the Russians looking toward a "covenant" for the control of the atom. With its covering letter, the memorandum is self-explanatory.

Communicates His Reservations to the President

September 11, 1945

Dear Mr. President:

In handing you today my memorandum about our relations with Russia in respect to the atomic bomb, I am not unmindful of the fact that when in Potsdam I talked with you about the question of whether we could be safe in sharing the atomic bomb with Russia while she was still a police state and before she put into effect provisions assuring personal rights of liberty to the individual citizen.

I still recognize the difficulty and am still convinced of the ultimate importance of a change in Russian attitude toward individual liberty but I have come to the conclusion that it would not be possible to use our possession of the atomic bomb as a direct lever to produce the change. I have become convinced that any demand by us for an internal change in Russia as a condition of sharing in the atomic weapon would be

so resented that it would make the objective we have in view less probable.

I believe that the change in attitude toward the individual in Russia will come slowly and gradually and I am satisfied that we should not delay our approach to Russia in the matter of the atomic bomb until that process has been completed. My reasons are set forth in the memorandum I am handing you today. Furthermore, I believe that this long process of change in Russia is more likely to be expedited by the closer relationship in the matter of the atomic bomb which I suggest and the trust and confidence that I believe would be inspired by the method of approach which I have outlined.

Faithfully yours,

HENRY L. STIMSON
Secretary of War.

MEMORANDUM FOR THE PRESIDENT

September 11, 1945:

Subject: Proposed Action for Control of Atomic Bombs. "The advent of the atomic bomb has stimulated great military and probably even greater political interest throughout the civilized world. In a world atmosphere, already extremely sensitive to power, the introduction of this weapon has profoundly affected political considerations in all sections of the globe.

"In many quarters it has been interpreted as a substantial offset to the growth of Russian influence on the continent. We can be certain that the Soviet Government has sensed this tendency and the temptation will be strong for the Soviet political and military leaders to acquire this weapon in the shortest possible time. Britain in effect already has the status of a partner with us in the development of this weapon. Accordingly, unless the Soviets are voluntarily invited into the partnership upon a basis of co-operation and trust, we are going to maintain the Anglo-Saxon bloc over against the Soviet in the possession of this weapon. Such a condition will almost certainly stimulate feverish activity on the part of the Soviet toward the development of this bomb in what will in effect be a secret armament race of a rather desperate character. There is evidence to indicate that such activity may have already commenced.

"If we feel, as I assume we must, that civilization demands that some day we shall arrive at a satisfactory international arrangement respecting the control of this new force, the question then is how long we can afford to enjoy our momentary superiority in the hope of achieving our immediate peace council objectives.

"Whether Russia gets control of the necessary secrets of production in a minimum of say four years or a maximum of twenty years is not nearly as important to the world and civilization as to make sure that when they do get it they are willing and co-operative partners among the peace-loving nations of the world. It is true if we approach them now, as I would propose, we may be gambling on their good faith and risk their getting into production of bombs a little sooner than they would otherwise.

The Bomb Makes Good Relations Imperative

"To put the matter concisely, I consider the problem of our satisfactory relations with Russia as not merely connected with but as virtually dominated by the problem of the atomic bomb. Except for the problem of the control of that bomb, those relations, while vitally important, might not be immediately pressing. The establishment of relations of mutual confidence between her and us could afford to await the slow progress of time. But with the discovery of the bomb, they became immediately emergent. *Those relations may be perhaps irretrievably embittered by the way in which we approach the solution of the bomb with Russia. For if we fail to approach them now and merely continue to negotiate with them, having this weapon rather ostentatiously on our hip, their suspicions and their distrust of our purposes and motives will increase.*[1] It will inspire them to greater efforts in an all-out effort to solve the problem. If the solution is achieved in that spirit, it is much less likely that we will ever get the kind of covenant we may desperately need in the future. This risk is, I believe, greater than the other, inasmuch as our objective must be to get the best kind of international bargain we can—one that has some chance of being kept and saving civilization not for five or for twenty years, but forever.

"The chief lesson I have learned in a long life is that the only way you can make a man trustworthy is to trust him; and the surest way to make him untrustworthy is to distrust him and show your distrust.

"If the atomic bomb were merely another though more devastating military weapon to be assimilated into our pattern of international relations, it would be one thing. We could then follow the old custom of secrecy and nationalistic military superiority relying on international caution to prescribe the future use of the weapon as we did with gas. But I think the bomb instead constitutes merely a first step in a new control by man over the forces of nature too revolutionary and dangerous to fit into the old concepts. I think it really caps the climax of the race between man's growing technical power for destructiveness and his psychological power of self-control and group control—his moral power. If so, our method of approach to the Russians is a question of the most vital importance in the evolution of human progress.

"Since the crux of the problem is Russia, any contemplated action leading to the control of this weapon should be primarily directed *to* Russia. It is my judgment that the Soviet would be more apt to respond sincerely to a direct and forthright approach made by the United States on this subject than would be the case if the approach were made as a part of a general international scheme, or if the approach were made after a succession of express or implied threats or near threats in our peace negotiations.

Stimson Advocates Direct and Prompt Approach

"My idea of an approach to the Soviets would be a direct proposal after discussion with the British that we would be prepared in effect to enter an arrangement with the Russians, the general purpose of which would be to control and limit the use of the atomic bomb as an instrument of war and so far as possible to direct and encourage the development of atomic power for

1. Italics added. Stimson later considered those sentences and one later passage to be the heart of the memorandum.

peaceful and humanitarian purposes. Such an approach might more specifically lead to the proposal that we would stop work on the further improvement in, or manufacture of, the bomb as a military weapon, provided the Russians and the British would agree to do likewise. It might also provide that we would be willing to impound what bombs we now have in the United States provided the Russians and the British would agree with us that in no event will they or we use a bomb as an instrument of war unless all three Governments agree to that use. We might also consider including in the arrangement a covenant with the U. K. and the Soviets providing for the exchange of benefits of future developments whereby atomic energy may be applied on a mutually satisfactory basis for commercial or humanitarian purposes.

"I would make such an approach just as soon as our immediate political considerations make it appropriate.

Urges Direct Negotiation Rather than International Debate

"I emphasize perhaps beyond all other considerations the importance of taking this action with Russia as a proposal of the United States—backed by Great Britain but peculiarly the proposal of the United States. Action of any international group of nations, including many small nations who have not demonstrated their potential power or responsibility in this war would not, in my opinion, be taken seriously by the Soviets.[2] The loose debates which would surround such proposal, if put before a conference of nations, would provoke but scant favor from the Soviet. As I say, I think this is the most important point in the program.

"After the nations which have won this war have agreed to it, there will be ample time to introduce France and China into the covenants and finally to incorporate the agreement into the scheme of the United Nations. The use of this bomb has been accepted by the world as the result of the initiative and productive capacity of the United States, and I think this factor is a most potent lever toward having our proposals accepted by the Soviets, whereas I am most skeptical of obtaining any tangible results by way of any international debate. I urge this method as the most realistic means of accomplishing this vitally important step in the history of the world."

HENRY L. STIMSON
Secretary of War.

2. Italics added: this was the most important point of all.

These opinions, which he urgently expressed again to the President and the Cabinet on the day of this retirement, were the ones with which Stimson left office. As an expression of his views in 1947, they were seriously incomplete. A major point of his September memorandum was that the best way to make a man trustworthy was to trust him. This point he publicly re-emphasized in his last press conference. But what if the man whose trust you sought was a cynical "realist" who did not choose to be your friend? What if Stalin and his lieutenants were in this final and essential test of purpose no different from Hitler? What if the police state were no transitional revolutionary device but a fixed and inevitable accompaniment of nationalistic aggression? Would trust and candor by themselves break down or even modify the menace to the world in such a case?

Next Two Years Showed Inadequacy of Official Policy

These questions and others like them acquired for Stimson new and pregnant meaning in the two years that followed his presentation of the September memorandum. The behavior of the Russians during this period filled him with astonishment and regret. Like many other Americans, he had met and talked with Stalin during the years of effective wartime alliance (at Potsdam in July, 1945). Like other Americans, he had received Stalin's cordial acquiescence in his general statement that Russia and the United States were natural friends and allies. But in the two years after Potsdam Russian policy everywhere was based on broken pledges, and the United States replaced Nazi Germany as the target of Communist abuse. Russian hostility to the Western democracies was not in the main a reaction to antecedent Western wickedness. It was the Russians who ended the wartime friendship.

Soviet threats against Greece and Turkey, Soviet aggression in Iran, and the maneuvers of Russian-dominated Communists everywhere raised deep and serious questions about the basic intentions of the Kremlin. It was a daring and imaginative democrat indeed who could ignore in 1947 the mountain of evidence supporting the hypothesis that Stalin and his associates were committed to a policy of expansion and dictatorial repression. In so far as it insufficiently emphasized this aspect of the Russian problem, Stimson's September memorandum was dangerously one-sided.

Stimson Approved the Policy But Not the Method Employed

Yet that memorandum was not designed to present a complete policy, but only to urge a certain tactical procedure. Presented at a time when some Americans were eager for their country to browbeat the Russians with the atomic bomb "held rather ostentatiously on our hip," it was designed to present an alternative line, aiming at a great effort to persuade the Russians that, in a choice between two worlds and one, they could find more profit in the latter. Stimson had no desire to criticize the course actually followed by the United States between September and December, 1945, but he did not believe that this course represented precisely the policy and method he had in mind in presenting his September memorandum. This was not by any means the result of a purely American decision; the Russians continued to make it extremely difficult for any American negotiator to conduct the sort of bed-rock discussion of fundamental problems which Stimson was advocating. The good faith and honorable intentions of those charged with American policy in this period seemed to Stimson unquestionable. If he had a difference with them it was in method and emphasis, and not in basic purpose. Nor could he claim with any certainty that his own policy would have been more successful. If there had been an immediate and direct effort, in September, 1945, to reach agreement with Russia on the control of atomic energy, would it have been successful? Stimson could not say. Much would have depended on the manner in which the attempt was made; there would have been required a clear understanding, detailed and definitive,

of what was meant by the "covenant" Stimson proposed; such a covenant would surely have involved more than the mutual assurances that had been so quickly violated by the Russians after Yalta and Potsdam. In talking with the Russians about the atom it would have been necessary to "talk turkey." If these points were not clearly stated in the September memorandum, it was because at that time it was Stimson's primary object to turn the thoughts of his colleagues back to the great principle of direct negotiation on basic issues which had been so long pursued by Franklin Roosevelt, and upon which Stimson's whole experience in forty years of public service had led him to rely. If the Americans and the Russians could reach real agreement, face to face, on atomic energy, then the world could breathe more easily and turn back with renewed optimism to lesser questions. In 1947 Stimson was inclined to think the chances of a successful direct approach in 1945 had been smaller than he thought at the time; but the existence of any chance at all would have justified the attempt, so great was the objective at stake.

Counsels Leaving the Door Open for Russian Cooperation

And even two years later he still believed that there was every reason to keep open wide the door to Russian-American agreement. The detailed plan for international control of atomic energy developed and advocated by the American Government he thoroughly approved. Yet he could not believe that in the United Nations Commission, in an atmosphere of charge and countercharge, with a dozen nations free to comment and amend, there was available to the United States the best means of winning Russian adherence to those proposals. The way to agreement was still in direct action.

But in 1947 he was no longer able to believe that American policy could be based solely on a desire for agreement with Russia, and writing in the summer of 1947[3] he saw the proper line of policy as a sort of synthesis of his two memoranda of 1945. He dismissed as "naive and dangerous" any refusal "to recognize the strong probability that one of our great and powerful neighbor nations is at present controlled by men who are convinced that the very course of history is set against democracy and freedom, as we understand those words."

He continued with an explanation of his unhappy conclusions: "We have been very patient with the Soviet Government, and very hopeful of its good intentions. I have been among those who shared in these hopes and counseled this patience. The magnificent and loyal war effort of the Russian people, and the great successful efforts at friendliness made during the war by President Roosevelt, gave us good reason for hope. I have believed—and I still believe—that we must show good faith in all our dealings with the Russians, and that only by so doing can we leave the door open for Russian good faith toward us. I cannot too strongly express my regret that since the early spring of 1945—even before the death of Mr. Roosevelt—the Soviet Government has steadily pursued an obstructive and unfriendly course. It has been our hope that the Russians would choose to be our friends; it was and is our conviction that such a choice would be to their advantage. But, for the time being, at least, those who determine Russian policy have chosen otherwise, and their choice has been slavishly followed by Communists everywhere.

Neither Complete Trust nor Belligerence Are Safe

"No sensible American can ignore this fact, and those who now choose to travel in company with American Communists are very clearly either knaves or fools. This is a judgment which I make reluctantly, but there is no help for it. I have often said that the surest way to make a man trustworthy is to trust him. But I must add that this does not always apply to a man who is determined to make you his dupe. Before we can make friends with the Russians, their leaders will have to be convinced that they have nothing to gain, and everything to lose, by acting on the assumption that our society is dying and that our principles are outworn. Americans who think they can make common cause with present-day communism are living in a world that does not exist."

But Stimson was not willing to accept the argument of extreme anti-Russians that only force would stop communism. "An equal and opposite error is made by those who argue that Americans by strong-arm methods, perhaps even by a 'preventive war', can and should rid the world of the Communist menace. I cannot believe that this view is widely held. For it is worse than nonsense; it results from a hopeless misunderstanding of the geographical and military situation, and a cynical incomprehension of what the people of the world will tolerate from *any* nation. Worst of all, this theory indicates a totally wrong assessment of the basic attitudes and motives of the American people. Even if it were true that the United States now had the opportunity to establish forceful hegemony throughout the world, we could not possibly take that opportunity without deserting our true inheritance. Americans as conquerors would be tragically miscast."

He preferred a middle course. "In dealing with the Russians, both uncritical trust and unmitigated belligerence are impossible. There is a middle course. We do not yet know surely in what proportion unreasonable fears and twisted hopes are at the root of the perverted policy now followed by the Kremlin. Assuming both to be involved, we must disarm the fears and disappoint the hopes. We must no longer let the tide of Soviet expansion cheaply roll into the empty places left by the war, and yet we must make it perfectly clear that we are not ourselves expansionist. Our task is to help threatened peoples to help themselves. . . .

The Facts of Our Strength Must Be Made Clear to Russia

"Soviet intransigence is based in very large part on the hope and belief that all noncommunist systems are doomed. Soviet policy aims to help them die. We must hope that time and the success of freedom and democracy in the Western world will convince both the Soviet leaders and the Russian people now behind them that our system is here to stay. This may not be possible; dictators do not easily change their hearts, and the modern armaments they possess may make it hard for their people

3. "The Challenge to Americans," Foreign Affairs, October, 1947.

to force such a change. Rather than be persuaded of their error, the Soviet leaders might in desperation resort to war, and against that possibility we have to guard by maintaining our present military advantages. We must never forget that while peace is a joint responsibility, the decision for war can be made by a single power; our military strength must be maintained as a standing discouragement to aggression.

"I do not, however, expect the Russians to make war. I do not share the gloomy fear of some that we are now engaged in the preliminaries of an inevitable conflict. Even the most repressive dictatorship is not perfectly unassailable from within, and the most frenzied fanaticism is never unopposed. Whatever the ideological bases of Soviet policy, it seems clear that some at least of the leaders of Russia are men who have a marked respect for facts. We must make it wholly evident that a nonaggressive Russia will have nothing to fear from us. We must make it clear too, that the Western noncommunist world is going to survive in growing economic and political stability. If we can do this, then slowly—but perhaps less slowly than we now believe—the Russian leaders may either change their minds or lose their jobs."

World Government and Atomic Control Depend on Good Will

In such a policy atomic control must wait for a change of attitude in Russia. Stimson continued to believe that "the riven atom uncontrolled can only be a growing menace to us all," and that "upon us, as the people who first harnessed and made use of this force, there rests a grave and continuing responsibility for leadership, turning it toward life, not death." He was further convinced that "lasting peace and freedom cannot be achieved until the world finds a way toward the necessary government of the whole." But he was forced to the conclusion also that these goals were dependent on Russian agreement. "We cannot have world government or atomic control by wishing for them, and we cannot have them, in any meaningful sense, without Russia. If in response to our best effort there comes no answer but an everlasting 'NO', then we must go to work in other fields to change the frame of mind that caused that answer. We cannot ignore it."

But the core of this statement, published on Stimson's eightieth birthday, was not his opinion of Russia, though that was what the press mainly noted. His central argument was directed once again, in hope and challenge, to the American people. Drawing on his unhappy knowledge of past failures as well as his experience of success, he summarized his understanding of the central issues of American foreign policy. And he found the final question to be "one of will and understanding." The following excerpts may stand as a better summary of his position than any restatement would be.

America's New Obligations in a World Community

"Americans must now understand that the United States has become, for better or worse, a wholly committed member of the world community. This has not happened by conscious choice; but it is a plain fact, and our only choice is whether or not to face it. For more than a generation the increasing interrelation of American life with the life of the world has outpaced our thinking and our policy; our refusal to catch up with reality during these years was the major source of our considerable share of the responsibility for the catastrophe of World War II.

"It is the first condition of effective foreign policy that this nation put away forever any thought that America can again be an island to herself. No private program and no public policy, in any sector of our national life, can now escape from the compelling fact that if it is not framed with reference to the world, it is framed with perfect futility. This would be true if there were no such thing as nuclear fission, and if all the land eastward from Poland to the Pacific were under the water. Atomic energy and Soviet Russia are merely the two most conspicuous present demonstrations of what we have at stake in world affairs. The attitude of isolationism—political or economic—must die; in all its many forms the vain hope that we can live alone must be abandoned.

"As a corollary to this first great principle, it follows that we shall be wholly wrong if we attempt to set a maximum or margin to our activity as members of the world. The only question we can safely ask today is whether in any of our actions on the world stage we are doing enough. In American policy toward the world there is no place for grudging or limited participation, and any attempt to cut our losses by setting bounds to our policy can only turn us backward onto the deadly road toward self-defeating isolation.

"Our stake in the peace and freedom of the world is not a limited liability. Time after time in other years we have tried to solve our foreign problems with halfway measures, acting under the illusion that we could be partly in the world and partly irresponsible. Time after time our Presidents and Secretaries of State have been restrained, by their own fears or by public opinion, from effective action. It should by now be wholly clear that only failure, and its follower, war, can result from such efforts at a cheap solution.

"We have fresh before us the contrary example of our magnificent success in wartime, when we have not stopped to count the cost. I have served as Secretary of State in a time of frightened isolationism, and as Secretary of War in a time of brave and generous action. I know the withering effect of limited commitments, and I know the regenerative power of full action. I know, too, that America can afford it—as who does not know it, in the face of our record in the last seven years? . . .

Reconstruction of Western Europe Is Our Responsibility

"The essential question is one which we should have to answer if there were not a Communist alive. Can we make freedom and prosperity real in the present world? If we can, communism is no threat. If not, with or without communism, our own civilization would ultimately fail.

"The immediate and pressing challenge to our belief in freedom and prosperity is in western Europe. Here are people who have traditionally shared our faith in human dignity. These are the nations by whose citizens our land was settled and in whose tradition our civilization is rooted. They are threatened by communism—but only because of the dark shadows cast by the hopelessness,

hunger, and fear that have been the aftermath of the Nazi war. Communism or no communism, menace or no menace, it is our simple duty as neighbors to take a generous part in helping these great peoples to help themselves.

"The reconstruction of western Europe is a task from which Americans can decide to stand apart only if they wish to desert every principle by which they claim to live. And, as a decision of policy, it would be the most tragic mistake in our history. We must take part in this work; we must take our full part; we must be sure that we do enough.

"I must add that I believe we should act quickly. The penalty of delay in reconstruction is to increase the size of the job and to multiply difficulties. We require a prompt and large-scale program. The Government must lead the way, but we who are private citizens must support that leadership as men in all parties supported help to our allies in 1941. The sooner we act, the surer our success—and the less it will cost us. . . .

"As we take part in the rebuilding of Europe, we must remember that we are building world peace, not an American peace. Freedom demands tolerance, and many Americans have much to learn about the variety of forms which free societies may take. There are Europeans, just as there are Americans, who do not believe in freedom, but they are in a minority, and . . . we shall not be able to separate the sheep from the goats merely by asking whether they believe in our particular economic and political system. Our co-operation with the free men of Europe must be founded on the basic principles of human dignity, and not on any theory that their way to freedom must be exactly the same as ours. We cannot ask that Europe be rebuilt in the American image. If we join in the task of reconstruction with courage, confidence, and good will, we shall learn—and teach—a lot. But we must start with a willingness to understand.

"The reconstruction of western Europe is the immediate task. With it we have, of course, a job at home. We must maintain freedom and prosperity here. This is a demanding task in itself, and its success or failure will largely determine all our other efforts. If it is true that our prosperity depends on that of the world, it is true also that the whole world's economic future hangs on our success at home. We must go forward to new levels of peacetime production, and to do this we must all of us avoid the pitfalls of laziness, fear, and irresponsibility. Neither real profits nor real wages can be permanently sustained—and still less increased—by anything but rising production.

Stimson Expresses Confidence in the Future of America

"But I see no reason for any man to face the American future with any other feeling than one of confident hope. However grave our problems, and however difficult their solution, I do not believe that this country is ready to acknowledge that failure is foreordained. It is our task to disprove and render laughable that utterly insulting theory. Our future does not depend on the tattered forecasts of Karl Marx. It depends on us. . . .

"We need not suppose that the task we face is easy, or that all our undertakings will be quickly successful. The construction of a stable peace is a longer, more complex, and greater task than the relatively simple work of warmaking. But the nature of the challenge is the same. The issue before us today is at least as significant as the one which we finally faced in 1941. By a long series of mistakes and failures, dating back over a span of more than twenty years, we had in 1941 let it become too late to save ourselves by peaceful methods; in the end we had to fight. This is not true today. If we act now, with vigor and understanding, with steadiness and without fear, we can peacefully safeguard our freedom. It is only if we turn our backs, in mistaken complacence or mistrusting timidity, that war may again become inevitable.

"How soon this nation will fully understand the size and nature of its present mission, I do not dare to say. But I venture to assert that in very large degree the future of mankind depends on the answer to this question. And I am confident that if the issues are clearly presented, the American people will give the right answer. Surely there is here a fair and tempting challenge to all Americans, and especially to the nation's leaders, in and out of office."

AEC Proposed Patent Compensation Regulations

Regulations governing procedures on applications for the determination of just compensation, a reasonable royalty fee, or the grant of an award under the Patents and Inventions Section of the Atomic Energy Act were published June 24 in the Federal Register by the U. S. Atomic Energy Commission.

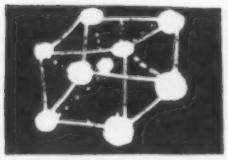
The Atomic Energy Act provides for establishment of a Patent Compensation Board to consider applications under the Act. Members of this Board have not yet been designated.

The proposed regulations set up procedure for the expeditious consideration of applications and at the same time safeguard the rights of the applicant.

Under the proposed regulations, there will be a preliminary examination of all applications by the Commission staff and provision is made for pre-hearing conferences to simplify or clarify the issues. Applicants have the right to be represented by counsel. The Board will afford each applicant an opportunity for a hearing at which evidence can be presented, in accordance with generally accepted procedures. The Board then shall prepare proposed findings to which the parties may file objection, after consideration of which, the Board will render a final decision on the entire record, together with a statement of its reasons determining the reasonable royalty fee, amount of just compensation or the amount of award.

The regulations were recommended to the Commission by its Patent Advisory Panel, which worked in consultation with the Office of the General Counsel. Members of the Patent Advisory Panel are William H. Davis, Chairman of the Department of Commerce Patent Survey Committee; Casper W. Ooms, former United States Commissioner of Patents; John A. Dienner, former President of the American Patent Law Association; Hector M. Holmes, of Fish, Richardson and Neave, Boston; and H. Thomas Austern, of Covington, Burling, Rublee, Acheson and Shorb, Washington, D. C.

ATOMIC POWER: WHAT ARE THE PROSPECTS?



M. H. L. Pryce

Dr. Pryce is Wykeham Professor of Physics at the University of Oxford and Executive Vice President of the British Atomic Scientists Association. During the war he engaged in radar research with the Admiralty Signal Establishment in England and in atomic energy research with the National Research Council of Canada.
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Atomic energy as a new source of power, capable of replacing or supplementing coal and water power, has been much in the news. The accounts in the daily press have often been conflicting—it has sometimes been stated that in a few years most of our electricity will be produced in atomic generating stations; other reports have given prominence to the view that atomic energy will never play a very important part. What is really the position?

Let it be said at once that it is impossible at present to give a precise answer. The course which the development of atomic energy will follow still depends on too many unknown factors. Nevertheless, it is possible, to some extent, to put the question against its proper background with relation to some of the more important factors. In this article I propose to consider atomic energy in relation to the supply of raw materials, and how long they may be expected to last, and to the time scale of development. The conclusion to be drawn does not support the optimistic view of atomic power stations in five years, and does not altogether exclude the pessimistic view that it has no important future. It does, however, give hope that in a few decades atomic energy may provide some relief of the fuel shortage.

Let us first consider the nature of the physical processes taking place when atomic (or, to be more precise, nuclear) energy is released, so that we may be clear what kind of applications it may have in the field of power production. The energy, for the most part, appears in the first instance as energy of motion of the fragments of atomic nuclei which have undergone fission. This energy is degraded into heat energy within a very short distance of the site of fission. Some energy is also carried away by gamma-rays and neutrons and is degraded into heat rather farther away (up to a foot). The rate at which heat is produced is controlled by quite simple devices which regulate the fission rate. It is limited by the rate at which heat can be removed to where it can be used, without raising the temperature of the nuclear reactor beyond the limits of safety.

To make use of the energy the heat must be converted into mechanical or electrical energy. As far as can be seen now this will be achieved in essentially the same way as with heat generated from coal, namely by steam- or gas-turbines or similar devices. No practical means has yet been devised, or is likely to be devised, of converting the fission energy directly into electrical or mechanical energy. In this respect nuclear energy plays the same role as does a fuel, such as coal or oil.

Heat can only be converted into useful energy with a reasonable efficiency if it is generated, and delivered to the prime mover, at a high temperature, of the order of several hundred degrees—a fact only too well known to power engineers. In a machine based on nuclear energy the temperature, and so the thermal efficiency, is limited by such factors as the strength of materials, complicated by intense bombardment from neutrons and other radiations, and corrosion, and there is still room for much research into these questions.

A feature peculiar to nuclear energy is that a nuclear machine, or reactor, will not work at all unless it contains a certain minimum quantity of fissile material, large compared with the consumption. It is as though a car would not go unless it had enough petrol in the tank to take it a million miles. This critical size differs greatly in different kinds of reactor. One delivering very little power and needing no cooling devices can be made quite small, but a power-producing reactor needs to be much bigger. Even the smallest pile that has ever been made, for experimental purposes, contains the energy-equivalent in fissile material of many hundred tons of coal.

Another feature not encountered in conventional power plants arises out of the intense radiation accompanying nuclear fission, consisting of beta-rays, gamma-rays and neutrons. The beta-rays are relatively harmless, being stopped by a few millimetres of matter, but the gamma-rays and neutrons have great penetrating power. If they were allowed to emerge where human beings are working they would constitute a grave danger to health, causing the same kinds of disease as are caused by over-exposure to X-rays, and must, therefore, be stopped. This necessitates a radiation shield, several feet thick, of some suitable material such as concrete.

In view of the enormous capital investment in nuclear fuel, and the necessity for cumbrous radiation shields, it is likely that nuclear energy will mainly be used in highly centralized electricity generating plants, the electricity then being distributed over a wide area. The necessity for the strict control of all fissile material required in the schemes that have been proposed at the United Nations Atomic Energy Commission serves to reinforce this conclusion. The era of atomic cars, trains and aeroplanes seems unlikely to come about. It is possible, however, that nuclear power may be used in big ships.

Three Fissile Substances

There is only one substance found on the earth whose nuclei are capable of sustaining a nuclear chain-reaction, on which the exploitation of nuclear energy relies, namely the isotope 235 of uranium (U235). It is

present in uranium to the extent of one part in 140, or 0.7 per cent. There are, however, *artificial* fissile substances, which can be made as products of nuclear reactions induced by the release of nuclear energy. Two, in particular, are of interest as they have a bearing on the problem of the large-scale exploitation of atomic energy. These are the isotope 239 of the new element plutonium (Pu239) and the man-made isotope 233 of uranium (U233). Both have nuclear properties similar to U235, and can in principle be used as the active agents of a nuclear reactor. Plutonium has, in fact, been used already in atomic bombs.

Plutonium is automatically produced in any nuclear reactor using natural uranium (as distinct from uranium in which the 235 isotope has been concentrated by isotope separation). It is formed by the capture of neutrons in the nuclei of the abundant 238 isotope of uranium (U238, abundance 99.3 per cent). The process takes place in three stages:

$$U238 + n \rightarrow U239 \rightarrow Np239 \rightarrow Pu239$$

Beta, 23 mins Beta, 2.3 days

U233 is produced in a similar manner from thorium. To make it, thorium must be introduced into a nuclear reactor. Thorium, atomic weight 232 (Th232), is converted by neutron capture into Th233 which after two radioactive transformations becomes U233:

$$Th232 + n \rightarrow Th233 \rightarrow Pa233 \rightarrow U233$$

Beta, 23 mins Beta, 27.4 days

To understand the bearing of these two fissile substances on the problem let us consider a reactor burning, to start with, ordinary uranium. As the reaction proceeds, U235 is used up, but plutonium appears to replace some of it. Under favourable conditions the reaction will proceed towards a condition in which there is no U235 left; all the fissions then take place in plutonium. Let us suppose this to be happening. For one nucleus of plutonium destroyed by fission some number, x say, of new nuclei of plutonium are produced, on the average, by capture of neutrons in the U238 left behind when the U235 was used up. After a time these x nuclei are destroyed by fission (thereby producing the heat which is the goal of the operation) and each one produces x new ones, x^2 in all. These in their turn produce x^3 which in their turn produce x^4, and so on. If x is less than one, the amount produced gets less and less, and the total energy generated from plutonium corresponds to the amount of plutonium originally present, multiplied by

$$1 + x + x^2 + x^3 + x^4 + \ldots = \frac{1}{1 - x}$$

If x is quite near to being equal to 1, this can be quite large, and it is evident that the energy obtained can be appreciably more than the energy directly derived from the U235 initially present.

The Process of "Breeding"

But a most interesting situation arises if x is greater than one. The amount of plutonium in that case increases as the reaction goes on, and can be extracted to be employed in the making of new reactors. This process, still hypothetical, is called "breeding," for obvious reasons. The increase goes on until all the U238 is used up by conversion into plutonium. A breeding system may, therefore, be regarded as one which effectively burns the abundant isotope of uranium.

Just as plutonium might be bred from uranium, so U233 might be bred from thorium. In this case it would be thorium which would be burnt up in the course of the reaction. The start of a U233 breeding process would be a little different, as thorium would need to be introduced deliberately into the initial stages which depend on the fission of U235, but once the process was under way the principle would be the same.

It is still unknown whether breeding is feasible, in other words, whether x is greater than one. In view of the detailed knowledge acquired in the construction of piles and atomic bombs, it may appear surprising that this is not known. It depends, however, on a very much more delicate balance of neutron production and utilisation than is required for the sustaining of a nuclear chain-reaction, and needs more accurate knowledge of nuclear constants.

Power Demands and Supply of Fissile Materials

We are now in a position to investigate the question of supply and demand—is there enough of the raw material of atomic energy to satisfy the demands for industrial power? The implications of atomic energy are such that we must think of it in global terms, balancing world demand against world supply. As a basis for discussion let us take the thesis that atomic energy is only going to be worth developing on an industrial scale if it is ultimately capable of satisfying an appreciable part of the world's heat and power. Precise figures are difficult to obtain, partly through uncertainty and partly owing to security restrictions, but for our purpose of tracing the broad outlines of the problem they are not necessary. In deciding whether a project is worth considering, an error by a factor of ten either way is in most cases unimportant. The annual world thermal requirements, for all purposes, are roughly 3000 Q, Q being an abbreviation for 1000 million kilowatt-hours. A substantial part of this heat is used in making electricity. It must, of course, be remembered that the conversion from heat to electricity takes place at fairly low efficiency; at 20 per cent. thermal efficiency, for each 100 Q of heat only 20 Q of electricity is developed.

Now one ton of fissile material, if completely used up by fission, releases roughly 20 Q of heat. This is equally true for U233, U235 and Pu239, as exactly as we need for the present discussion. It may with interest be compared with the figure for coal—one million tons of coal furnish roughly 7.5 Q. In other words, weight for weight, fissile material yields nearly *three million times* as much heat as coal.

To satisfy the annual thermal requirement of 3000 Q we need $3000/20 = 150$ tons of fissile material per annum.

In terms of raw materials (uranium, thorium) this demand takes very different forms according as breeding is or is not a practical possibility. Let us first consider the pessimistic hypothesis that breeding is not possible. Then the fissile material available is U235, together with plutonium formed as a by-product of its fission. The secondary plutonium might multiply the effective amount of fissile material by a factor of five without straining the hypothesis too much. The raw material in this case is uranium, containing 0.7 per cent. of U235, equivalent, with this estimate of the effect of secondary plutonium, to 5x0.7 per cent. = 3.5 per cent. of fissile material for the purpose of heat production. The uranium requirements are, therefore, $150 \times 100/3.5 =$ (roughly) 4000 tons a year.

Let us now turn to the more optimistic hypothesis that breeding is possible. The raw materials are now either uranium or thorium, according as we use plutonium or U233 as the fissile material. In the breeding process the raw material gets converted into fissile material, and the consumption must be considered essentially as consumption of raw material. This means an annual consumption of 150 tons of uranium or thorium as the case may be.

These requirements must be related to the available supplies. Uranium is not a really rare material. It is, for instance, more plentiful than gold. But it occurs, for the most part, in very low concentrations in rocks such as granite, from which it is not economical, at least with any method known at present, to extract it. Rich ores, such as those of the Belgian Congo and Great Bear Lake are relatively rare, and only a limited total quantity of uranium is available from them. It is difficult to estimate the world's stock of uranium from workable ores, as it still remains a military secret—but a rough guess, not likely to be out by more than a factor of ten, can be attempted. For the present discussion let us assume that the world's supply of uranium will continue at the pre-war rate of 1000 tons a year available from good ores for, say, ten years—making 10,000 tons in all for that period.

Thorium is more abundant than uranium and already before the war was mined for its industrial applications to the extent of from 500 to 1000 tons annually, and there seems no reason to believe that the world's stock will not last for centuries at this rate.

With these figures we see that, on the assumption that breeding is *not* possible, the 10,000 tons of uranium suggested would be sufficient for only two and a half years' work when used up at the rate demanded by total replacement of existing sources of power by atomic energy. The extreme roughness of this figure must be stressed. It might quite well be as long as 25 years, or as short as three months. One broad conclusion can be drawn. If breeding is impossible, the future of atomic energy as a long-term substitute for coal depends on the economical extraction of uranium from low-grade ores, the rich ones being able to satisfy the demand for only a short period.

On the assumption that breeding is feasible, however, the situation is rather different. With uranium, consumed at the rate of 150 tons annually, the assumed output of high-grade ores is enough to last 10,000/150 or roughly 70 years. Making allowance for our uncertainties, let us say between 7 and 700 years. Clearly, more precise figures would be desirable, but even in their absence the situation looks more hopeful. The long-term solution may still depend on the extraction of uranium from low-grade ores, but the time available for development of the extraction techniques is more reasonable.

With thorium, assuming breeding of U233 is possible, the annual demand of 150 tons is quite small compared with the pre-war annual output of thorium, and the exhaustion of supplies seems remote. If breeding of U233 is feasible, therefore, there is every reason to believe that atomic energy can play a very important part in power production.

Time Scale of Industrial Development

Let us now inquire into the time scale of the development of atomic energy for industrial purposes. Without breeding, this is mainly determined by the time required to develop, and put into large-scale operation, methods of extraction of uranium from poor ores—I would prefer not to commit myself to a figure for this, though I would guess the time to be measured in decades. The present piles, which use natural uranium, contain a capital investment of uranium equivalent to the consumption of decades; if the future reactors are going to be similar in this respect, the initial amounts of uranium required are going to be much greater than the annual consumption or even than the stocks from high-grade ores. This consideration will further retard the development.

The really interesting case is U233 breeding from thorium. The development can be considered in two main stages. The first stage is the burning of U235 (the only naturally occurring fissile material) and the synthesis of U233. The second is the breeding proper, atomic power being developed in reactors containing U233 and thorium.

In the first, or conversion stage, the reactors contain natural uranium, which, because of the high degree of neutron loss in U238, present little flexibility of design and are limited to relatively low rates of heat extraction, and therefore of conversion. Allowing time for research into the problems involved, and for a major constructional programme, a figure of ten years does not seem unreasonable for the conversion stage.

The product of the conversion is U233. Assuming all the world supplies of uranium were accumulated over our hypothetical ten-year period and stock of uranium invested in this programme, we start with 10,000 x 0.7 per cent. = 70 tons of U235, which is converted, at probably a good deal less than par, into U233. For the sake of argument, let us suppose that the yield is 50 tons of U233.

The next question is how quickly the U233 multiplies. This depends on two main factors:

(a) The average number of fissile nuclei, in excess of one, which are produced when a nucleus is destroyed by fission. In other words what we have called x—1.

(b) The average time that elapses before a nucleus in the reactor undergoes fission.

As we have seen, x is so uncertain that it may not be even greater than one, but, on the assumption that it is, we can estimate the order of magnitude of x—1—it is probably quite small. For the present discussion let us assume that it is 0.1, i.e. $x = 1.1$; for each 10 fissile nuclei that disappear, 11 new ones are born. Or, in the language of investment, the interest rate is 10 per cent per life-cycle.

The average life-time of a fissile nucleus in the present types of pile is not a published figure, but within the accuracy of a factor of ten either way it may be estimated from published material to be between 10 and 1000 years. It is clear that unless a much shorter life-cycle can be achieved, the building-up period will be very long. The problem is essentially one of heat-transfer—the quicker heat can be removed, the quicker can be the fission rate, and the shorter the life-cycle. In fact, the U233 reactors will not be subject to such limitations on materials and mode of construction as piles using natural uranium, and it is reasonable to expect that a great improvement can be made over present-day piles. To fix our thoughts, let us assume that a life-cycle of one year can be achieved, with our usual proviso about the factor of ten. Actually, it cannot be very much shorter, for besides the time that the U233 takes in undergoing fission we must also con-

sider time spent in chemical extraction and purification, which is probably necessary between cycles; because of the fact that U233 is only formed after two radioactive transformations, which take time, and because of the high initial radiation level from the radioactive fission products, the chemical processing time is probably of the order of months.

Combining these figures ($x = 1.1$, life-time = 1 year), we arrive at an interest rate of 10 per cent per annum.

We have assumed that we shall be starting the breeding stage with 50 tons of U233. After one year the amount of U233 will be $50 \times 1.1 = 5$ tons. After two years, $55 \times 1.1 = 60.5$ tons; and so on. The ultimate requirement is for a *consumption* of 150 tons per annum. We can estimate what this means in terms of capital stocks from the assumption that the life-cycle of U233 is one year. This gives us a capital requirement, ignoring the needs for reserves and other possible diversions, of 150 tons. Let us assume another 150 tons for reserves, etc. This makes the eventual requirement 300 tons. At 10 per cent per annum, this takes 19 years ($50 \times (1.1)^{19} = 306$). Let us say 20 years for the sake of a round number.

On the basis of these particular figures we conclude that it would take thirty years (10 + 20) to develop atomic energy, operating on a breeding principle, to the stage where it could effectively replace other sources of power. The extreme roughness of this figure cannot be over-emphasized. But what is important is the *order of magnitude*. Atomic energy cannot be developed on an industrial scale in five years, nor is the development likely to need several centuries (unless indeed all the pessimistic hypotheses are the correct ones, in which case it will play no useful part in power development).

The foregoing estimates have been made on the assumption that the aim is almost total replacement of existing sources of power by atomic energy, but the conclusions are not very different if the aim is merely to alleviate the difficulties of the coalmines in this country. It is the initial stages of the development which take time. Nor does treating the problem on a national, instead of a global, basis make much difference: present British power needs are about 10 per cent of the world total; the British allocation of raw materials is unlikely to be much different from 10 per cent of available supplies.

In view of the great technical uncertainties concerning the development of atomic energy, it is premature to forecast the cost of power produced from atomic energy, but it may be interesting to mention that an official American report on the probable cost of electricity from an atomic generating plant, using techniques rather similar to those in use in existing atomic piles, estimates it to be comparable with the cost of electricity generated from coal.

Quite apart from the still unknown snags to be met with in the technical development, it will be seen that there are two major uncertainties concerning the future of atomic energy—the possibility or otherwise of breeding and, if it is impossible, the economic extraction of uranium from low-grade ores. If no satisfactory answer is found it may well be doubted whether atomic energy has any useful large-scale future. If, on the contrary, one or other uncertainty is satisfactorily resolved, a few decades from now may well see the large-scale use of atomically generated power, and the raw materials ought to last sufficiently long to allow human ingenuity to find new sources of power before they run out.

A. E. C. Terms Extended For Two Years

On July 3 President Truman signed Public Law 898 extending the terms of the present members of the Atomic Energy Commission to June 30, 1950. According to the Atomic Energy Act of 1946, the terms were due to expire August 1, 1948. In a statement accompanying the bill, President Truman said in part: "I consider that this bill is not in the best public interest since it invests the atomic energy program with an aura of uncertainty and of partisan politics.

"Nevertheless, if I had not signed it, the terms of the commission members would have expired on Aug. 1, 1948. I could then have made only temporary appointments, which would detract greatly from the continuity and effectiveness of the national atomic energy program at this critical time.

"Politics and atomic energy do not mix. The refusal of the Republican leadership to put the public interest first can only create an impression at home and abroad that the Congress has failed to grasp the full significance of atomic energy to our national security and to our responsibility as a nation dedicated to peaceful reconstruction."

FAS Urges International Office for Isotope Distribution

The Federation of American Scientists released a report on May 25 which proposed that the United Nations undertake the international distribution of the new isotopes, both radioactive and stable. Asserting that these isotopes will contribute a very substantial share of the peacetime benefits of atomic energy, and that present modes of distribution lead to criticism of the United States which is generally unjustified, they suggest that an office in the U. N. should be set up. They believe that essential research in medicine, agriculture, and industry may be seriously delayed if some such procedure is not developed within the next few years.

Professor Arthur Roberts, physicist at the State University of Iowa, and chairman of the Federation of American Scientists, stated that, "The atomic scientists, both in California and Washington, have been studying the matter of the international distribution of isotopes for more than a year. We have tested the ideas both with other scientists and with specialists in international relations, and therefore have confidence that this is a desirable course to take.

"We have no illusions that discussion and possible agreement on non-dangerous aspects of atomic energy will have any real effect upon hastening agreement on those unsettled issues affecting national security. However we have been assured that if agreement on the control of atomic weapons could be secured in the future, the existence of a functioning organization in the atomic energy field would greatly speed up the process of administering the control scheme. Therefore the proposal might well be undertaken by the United Nations Atomic Energy Commission if the General Assembly deems it advisable.

"We believe that this is one instance where the benefit of the other countries' science redounds to the advantage of the United States as well. It is an area within the realm of science which may improve the instruments of cooperation that are so necessary for the establishment of a stable world community."

ON THE APPLICATION OF INTELLIGENCE TO WORLD AFFAIRS

Quincy Wright

Professor of International Law at the University of Chicago and author of A STUDY OF WAR, Dr. Wright is one of the social scientists who has participated in the activities of the atomic scientists from the beginning.

One difficulty with which the world is faced is the absence, even in the minds of the wisest, of conviction concerning the direction in which movement should take place. The arguments for and against socialism and capitalism, national sovereignty and world government, individual liberty and collective will, conciliating Russia and containing Russia, are so convincing that no one who understands the problems wants to commit himself to one or the other of these alternatives.

The partisans are committed and the masses, convinced that these alternatives state the problem, await to be told which they should select. Unable to tell them, the leaders lose prestige, with the results of partisan warfare, partisan leadership, wobbling, and universal scepticism.

May there not be in this apparently gloomy situation an opportunity for intelligence? May not the opportunity exist for educating the public to the belief that simple alternatives seldom state the whole of any social problem? Assertion of such simple alternatives is a tool of warfare, whether military, economic, or psychological. Search for a larger range of choice and exploration of the possibilities of more complex proposals is a tool of reason. May not the obvious inadequacies of the simple alternatives with which the propagandists deafen the ear provide an opportunity for enlightenment on the difference between reason and war?

Here, however, it may be said: You are committing the sin you describe. The contrast of reason to war is another of those simple alternatives which seeks to limit choice to policies neither of which is wholly desirable. Reason has the merit of imagining and exploring the possibilities that might be chosen, but it may permanently frustrate action. It may justify fiddling while Rome burns. War has many evils, but a firm decision and commitment to action may be the only solution to a pressing problem. It may be better to give whole-hearted allegiance to a program which may be only second or third best than to have no program at all.

There is merit in this criticism. The contrast of war and reason is itself an over-simplification. There may be possible choices different from either.

There may, for example, be commitment to a policy or principle not so absolutely as to invite war, but within the orbit of defined procedures. There may be a utilization of reason, not to the extent of investigating all the possible policies which can be imagined or the last consequence of each, but so far as time and circumstances permit. Descartes recognized that "sufficient reason" is all that can be expected for practical action, and Justice Holmes remarked that every moment we stake our lives on predictions that are far from certain.

It is the function of intelligence to break through the bonds of simple alternatives, and this applies to the often assumed contrast between understanding and action, no less than to other dichotomies. Action, which implies assault on things as they are or tend to be, implies resistance and faces some risk of war, however carefully the consequences have been explored by fallible man. Understanding, which implies investigation of all possible developments of, and interventions in, a situation also implies deliberation and faces the risk of indecision and drift while matters go from bad to worse.

Only with God and inert matter are reason and action perfectly united. God can unite them because his omniscience foresees all the consequences of action, and his omnipotence assures the triumph of his act, even though interludes of conflict with the Devil may occur; but since the occurrence and results of such conflict are foreseen and provided for, it should not be called "war" but "police action."

Inert matter, on the other hand, can unite reason and action because the individual choice of each of its constituents is so small and their number is so great that the statistical principle of large numbers assures that the results of action upon it can, in considerable measure, be predicted by the application of previously formulated laws of nature. Because man has more intelligence and more freedom than the atom and less than God, his actions with respect to himself always involve risk. He cannot, by any use of reason, avoid responsibility to appraise the risk and to decide whether the circumstances justify it.

It is not possible in the space of this article to examine fully the simple alternatives mentioned earlier, but perhaps suggestions can be made pointing the direction of other possible choices.

The Problem of Freedom under Socialism and Capitalism

The value of socialism in presenting the possibility of a vertical expansion of a community's economy and in avoiding the dangers inherent in the horizontal expansion of many national economies in a shrinking world, has been mentioned by Harold Laski and others.[1] These writers, however, give insufficient attention to the danger that socialism, conducted by national governments, preoccupied with problems of defense, will utilize the possibilities of economic planning, not for welfare, but for augmenting national power as an instrument of security and economic bargaining if not of expansion. In the process the individual may be ground down by the social juggernaut, lack of incentive may restrict production, and total war may ensue. The socialisms which have been experienced in history have been state socialisms, and they have proved dangerous to liberty, prosperity, and peace.

Capitalism has the virtue that it presents the possibility of a separation of politics and economics, thus

1. *Foreign Affairs*, Vol. 26 (October, 1947), pp. 40-42.

permitting each to check excesses of the other. This possibility was in considerable measure realized in the nineteenth century, to the benefit of liberty, prosperity, and peace in Europe. Mr. Anthony Eden in referring to this mentioned the danger that monopoly, abusive exercises of power, and periods of depression may grow out of capitalism, and agreed that planning for freedom is necessary.[2] He perhaps underestimated the difficulty of restoring and maintaining a free economy under conditions in which men are able both to perceive economic inequities and to use the machinery of the state to rectify them.

The separation of economy and polity is hardly practicable in a democracy unless all citizens recognize that neither liberty nor equality can be enjoyed completely without destroying the other. If democracy exaggerates its demand for equality, it tends to produce socialism, which is likely to destroy the civil liberties which are its essence. If capitalism exaggerates freedom including freedom to combine for the maintenance of wages and prices, it tends to produce monopoly which also leads to socialism.

The evils of both socialism and capitalism are so manifest that the search for alternatives in various forms of mixed economies has proceeded. Stability is the consequence, not of simplicity, but of complexity. We may expect that a pattern including both competition and cooperation may develop in which government corporations, state enterprises, free enterprise, and regulations, both national and international, will all have a role. Such a pattern may provide answers to some of the evils of both socialistic and free market economies and permit reasonable liberty without excessive inequalities. That it is difficult to permit government enterprise and regulation, sufficient to prevent private monopoly and exploitation, without destroying market freedom sufficient to regulate basic price relations, no one can deny.

National Sovereignty and World Government

The contrast between national sovereignty and world government is not new. It is, however, novel to find the leading Marxist country the outstanding advocate, both theoretically and practically, of state sovereignty, while the leading advocate of capitalism, of democracy, and of nationalism has developed within it the most powerful movement for world government, and has proposed officially, far-reaching steps for the actual control of sovereign action in the important field of atomic energy by a vetoless world authority. The cosmopolitans have become nationalist, and the nationalists have become cosmopolitan.

The contributions which particularistic nationalism and claims of self-determining sovereignty have made to the initiation of war have been recognized by most serious students of the subject. National sovereignty has also presented grave difficulties to the utilization of the world's resources for promoting human welfare. It is not surprising that the experience of two world wars and the obvious instability of a world in which national security rests on an increasingly bipolar balance of power have converted nationalism and sovereignty into terms of reproach. On the other hand, the potentialities of a world state for oppressing humanity and for frustrating progress have not escaped the attention of most thinkers.

Universal states have developed in the limited civilizations of the past, but, according to Arnold Toynbee, they have tended to degenerate, to stagnate, to oppress and to disappear in periods of human misery which end the civilization which they sought to integrate.[3] Now that man has put all his eggs into the one basket of a developing world civilization, such a collapse would be devastating.

With national sovereignty, we may be physically destroyed by atomic warfare; with world government, civilization may be destroyed by oppression, corruption, and disintegration. Here again it is well to recall that stability is the product of complexity. The United Nations includes elements of empire, of balance of power, of federation, and of international cooperation. If the great powers agreed, they could, under the Charter, rule the world. Only because of the probability of their disagreement can the small powers hope to retain their freedom. But if the great powers do not agree, they can be controlled only by their mutual fears, and the world's peace depends upon the unreliable equilibrium of their power.

Yet the possibility, envisaged by the Charter, that the General Assembly may develop and lead a world public opinion, and provide direct protection for human rights even against national authorities, points toward federation. The recent moves of the General Assembly to interpret the limits of domestic jurisdiction relatively, and to assert authority when the Security Council is unable to act, suggests that the United Nations may assume a more federalistic character than the makers of the Charter probably intended.

The United Nations may develop into something different from either national sovereignties or world government. It may facilitate the development, hoped for by Mr. Dewitt Poole, of a more complex balance of power.[4] Balance of power systems have in the past tended, through the process of conquest of the lesser states by the greater, toward a reduction in the number of states involved, and toward less frequent but more devastating wars, until eventually a universal empire has been established through the conquest by one of all those remaining. China thus moved from the period of Confucius to the period of "warring states," ended by the universal conquest of the T'sin Empire in the third century B.C. The history of classical civilization culminating in the universal empire of Augustus was similar.

Such a course is typical historically, and perception of the ways of power makes it appear probable so long as each state must rely for security on the superiority of its own power over that of its most dangerous rival. More complex and more stable equilibria which might arise from the development of a larger number of independent centers of power cannot be expected except within the frame work of a world order whereby the whole, without exercising the supreme power of a world government, yet has sufficient power in itself to prevent aggression and to give force to the law of nations.

The United Nations has the possibility of developing in several directions which would provide alternatives different from either national sovereignties or world government, and which perhaps offer more hope for the future. The difficulty of keeping sovereignty divided must, however, be recognized.

The Individual and the Group

The debates in the human rights commission of the United Nations have made it clear that the world is

2. *Ibid*, p. 19 ff.

3. Toynbee, Arnold, *A Study of History*, New York, 1947.

4. *Life Magazine*, September, 1947, p. 76.

not prepared to accept either the individual or the group as the supreme value. The West places first the human rights to be free in the choice of religion and opinion, to be free to communicate, and to be free from oppression, whether by the group or by others. The East, on the other hand, places first the human rights to be fed, clothed, and housed by the group.

The effort to combine the two points of view in President Roosevelt's Four Freedoms has not eliminated the conflict. The group can more easily assure its members freedom from fear and from want if it directs them without regard for their civil liberties. Freedoms of opinion, communication, and activities, especially economic activities, hamper the state in its planning and direction to assure a livelihood for all citizens.

The evils of excessive individualism and excessive collectivism are evident in theory and the need and difficulty of compromise becomes manifest when efforts are made to interpret and apply constitutional bills of rights. Such applications make it clear that rights of the individual are relative to the right of the community to protect itself from "clear and present dangers" and that exercises of national power are relative to the expectations of human rights sustained by a vigilant public opinion. In these relativities, mankind, by complicated rules of law, may find alternative choices to the simple dichotomy between the individual and the state.

Conciliating and Containing Russia

Mr. Wallace and Mr. Byrnes, in the controversy which led to the former's retirement from the cabinet in September, 1946,[5] precipitated the idea that Russian-American relations must be defined in terms of the alternative of conciliation or containment. Appeasement versus toughness is another but less friendly way of expressing the idea. Mr. X has argued for containment on the ground that the Soviet state by its ideology, by its need of maintaining domestic authority, and by the requirements of a monolithic party, is irrevocably committed to the proposition that the capitalistic world is its enemy. According to this opinion, Soviet conciliation with the West is impossible. The Soviets must continually strive to conquer.[6]

If this opinion is true, efforts at conciliation are mistaken. The Soviets will understand no argument but force; consequently unless their expansion is made physically impossible, it will take place, and the balance of power will eventually be overthrown in their favor. Containment therefore seems necessary. But on the other hand, containment provides the justification for the Soviet theory that the world is their enemy. It strengthens their will to expand and stimulates them to develop the means for implementing that will. Containment of an expanding gas prepares the way for explosion.

The advocates of conciliation, therefore, argue that containment is self-defeating, and that, on the other hand, under appropriate conditions a spirit of conciliation may be reciprocated. Examples are cited in which hostile rivals have accepted policies of cooperation.

It must be admitted, however, that such incidents have seldom occurred in the game of power politics unless both rivals have found themselves faced by a new power which they feared more than they feared one another. Britain and France were able to conciliate after Fashoda because Germany was becoming a menace to both. The West and the Soviet could conciliate during the war because both were fighting for their lives against the Axis.

An effort at conciliation between states each of which is dependent for security on its own arms and each of which fears attack by the other is likely to be interpreted as weakness or as a strategic maneuver, and to bring little favorable response. This certainly has been the post-war experience in relationships of the West and the Soviet Union.

Can other alternatives be found? Mr. Benton hoped that the Voice of America might reach behind the iron curtain and create there a new state of mind.[7] Mr. Burnham thinks that persuasion and containment are both hopeless and urges isolation of the Soviet Union and preparation for war.[8] Others have hoped that a meeting of heads of state might be effective. Stalin alone in Russia, it is thought, may be free to change his mind.[9]

Others have hoped that the development of world opinion through the United Nations[10] or the organization of the West into an overwhelmingly powerful federation,[11] or the building up of a third great power through union of Western Europe[12] may bring the argument of facts to persuade the Soviet Union to abandon policies of expansion which might then become hopeless. Mr. Lippman believes that if Soviet troops can be got out of Germany and Austria, the European situation will become more stable.[13] Mr. Poole thinks if the Soviet Union became one of nine major centers of power, instead of one of two such centers, the world would become stable.[14]

Mr. X hopes that containment can succeed until Stalin dies, when, if not before, changes within the Soviet Union may alter the situation. Discontent, he points out, can hardly be absent within the Soviet structure, rich in secret police, purges and discipline, but poor in consumers' goods, civil rights, and information about the outside world.[15]

More recently Secretary Marshall has suggested that success in building the economy of Western Europe will create conditions under which the Soviet Union will see that for the time being a policy of fomenting chaos and expanding Communist parties is impracticable and will change, for a time at least, to the opposite policy of establishing normal relations with the West for mutual economic benefit.[16] Such a change it has been pointed out, was evident in Soviet policy in the late 1920's after conclusion of the Locarno Agreements.

Ingenuity Needed to Devise Means of Avoiding War

From such suggestions as these and from further imaginative thought, alternatives better than either conciliation or containment may be found. The ceaseless search for them, even while we are pursuing one, is the part

5. Byrnes, James, F., *Speaking Frankly*, New York, 1947.
6. *Foreign Affairs*, Vol. 25 (July, 1947), p. 566 ff.
7. "National Defense and National Reputation", Department of State *Bulletin*, Vol. 16 (Feb. 2, 1947), p. 202 ff.
8. Burnham, James, *The Struggle for the World*, New York, 1947.
9. Szilard, Leo, "Letter to Stalin", *Bulletin of the Atomic Scientists*, Vol. 3, No. 12 (December, 1947), and "Comment", *Ibid*, Vol. 4, No. 3, (March 1948). See also news column by Eleanor Roosevelt, March 12, 1948.
10. Meyer, Cord, Jr., *Peace or Anarchy*, Boston, 1947.
11. Streit, Clarence, *Freedom and Union*, Vol. 2 (August-September, 1947), p. 4, and Urev, Harold, *Ibid*, Vol. 2 (July, 1947), p. 12.
12. de Kieweit, C. W., in *A Foreign Policy for the United States* (Q. Wright, ed.), Chicago, 1947, p. 18 ff.
13. Lippman, Walter, *The Cold War*, New York, 1947.
14. *Life Magazine*, September, 1947, p. 76.
15. *Foreign Affairs*, Vol. 25 (July, 1947), p. 566 ff.
16. Address at Des Moines, February 13, 1948, Department of State *Bulletin*, Vol. 18 (February 22, 1948), p. 231.

of wisdom. The world is certainly in danger from tendencies which will lead to general war unless human ingenuity devises methods of changing them.

The power system is tending to become bilateral and such a system cannot be stable. War devastated areas are tending to deteriorate further and to afford favorable opportunities for radical propaganda. Respect for legal procedures is tending to decline and the belief that any means can be justified by a sufficient end is tending to grow. The power of the military offensive over the defensive is tending to increase through the use of airborne super-explosives and a universal fear of sudden and devastating attack is developing. Can anything be done to rectify these dangerous tendencies of power, economy, law, and technology?

Problems Involved in Stabilizing Western Europe

The power equilibrium might become more stable if Western Europe became an independent center of power, and if the United Nations became more powerful relative to the states, either through developing its own military contingents and its capacity to make decisions promptly, or through a general reduction of national armaments. Efforts in both of these directions are in progress.

Economic improvement in the war devastated areas cannot be expected to proceed with sufficient rapidity without aid from the more fortunate countries. Immediate sustenance, capital replacements, technical skills and restoration of domestic order are needed in varying degrees in these areas. Detailed local knowledge is necessary to appreciate the relationship of these needs and to plan the order of priority in supplying them. The European Recovery Program has led to the assembly of much of this information within the field of Western Europe.

Respect for law implies genuine and wide-spread appreciation of the virtue of following established procedures, and is considered by many a necessary condition of civilization. Such respect is difficult to rebuild rapidly once it is impaired. Experience with two world wars and widespread propaganda of novel political and economic doctrines with religious fervor and with new means of mass-communication has won many recruits to the belief that the ends thus propagandized justify any means to attain them. Only patient effort utilizing established procedures in the United Nations and in international and national tribunals, buttressed by scholarly analyses and popular education can restore appreciation of the value of law and then only if men are freed from the fear of sudden annihilation.

Reduction of the efficiency of military attack by any group is therefore an important element in political stabilization and in economic and legal recovery. By regulating the weapons available and the means for making them, the power of defense may be increased and the incentive to attack reduced. The slow progress of atomic energy negotiations is a cause of prime concern, especially when, as was to be expected, this delay has resulted in a race between the United States and the Soviet Union, in the development of airplanes, rockets, atomic bombs, and bacterial agents. Limitation agreements supported by international inspection and control are essential if this race is to be stopped.

Possibly such agreements will become easier if they include a long moratorium upon the production and use of atomic energy in the large quantities which would be required for economic utilization. The atomic scientists and the economists doubt whether atomic energy can in many places in any near future, compete in price with other sources of energy. Consequently the economic loss from such a moratorium might not be great. The utilization of fissionable materials in medicine and in industrial testing requires the production of such materials only in "safe" quantities and would not be affected.

Problems in Control of Technology and Science

The problem of keeping progress in science and technology in step with progress in social opinion and organization is one that both scientists and statesmen must face more seriously than they have during the past few centuries.[17] Advances in pure science must not be in any way retarded. Scientific freedom is a major value of civilization. It should not be assumed, however, that the production of any gadget is desirable merely because it can be used for some purpose when society is not yet developed adequately to control its misuse. Technology must be distinguished from science.

Practical intelligence induces the ceaseless application of reason and imagination to find new and better courses of action. Such intelligence is wary of simple statements of problems and simple solutions. It recognizes that stability is a function of complexity, and yet that action in time, with all its risks, may be better than search, through further investigation and discussion, for a better course while the boat departs. If more practical intelligence in the disturbed state of our world cannot be beneficial, it is difficult to say what can be.

17. P. W. Bridgman, H. C. Urey, W. F. Ogburn, et al. "Scientists and Social Responsibility," *Bulletin of the Atomic Scientists*, Vol. 4 (March, 1948), No. 3.

AEC To Establish Chemical Laboratory

The United States Atomic Energy Commission will establish a chemical laboratory in New Brunswick, New Jersey, to provide precise analytical quality control of special materials used in the national atomic energy program, the Atomic Energy Commission announced on June 25.

The announcement followed acquisition by the government of an option on property and a building for the laboratory in New Brunswick. The laboratory when completed will represent an investment of over a million dollars.

To be known as the New Brunswick Laboratory, the new AEC installation will provide facilities for quality control of material processed in plants under the supervision of the AEC's New York Office. Operations under the New York Office include the processing of uranium, beryllium and other ores and material of importance in the development of atomic energy.

Operation of the laboratory may ultimately require the services of approximately 65 scientific and technical personnel and about 18 clerical and administrative personnel.

Modification of the building and installation of equipment wiill begin immediately. It is anticipated that the New Brunswick laboratory will be ready to begin operation as a precision analytical laboratory by fall.

UNITED NATIONS ATOMIC ENERGY NEWS

Peter Kihss

Mr. Kihss, the representative of the NEW YORK HERALD TRIBUNE at Lake Success, reports negotiations on atomic energy control for the BULLETIN.

The United Nations struck a Soviet veto in the Security Council last June 22 in the majority Atomic Energy Commission plan for internationalizing atomic energy, and thereupon sent the problem to all its fifty-eight members, meeting in the Assembly in Paris this September.

The Soviet veto prevented formal adoption of the commission's recommendation for its own suspension until such time as Soviet opposition relaxes. Under the rules, any member can call for a commission session again at any time.

Following is the vetoed resolution, introduced in the Council on June 11, by Dr. Philip C. Jessup, of the United States:

Resolution Favoring UN AEC Reports Introduced in Security Council

"The Security Council, having received and examined the First, the Second, and the Third Reports of the United Nations Atomic Energy Commission, Accepts these reports and, approves the General Findings (Part II C) and Recommendations (Part III) of the First Report, and the Specific Proposals of Part II of the Second Report as constituting the necessary basis for establishing an effective system of international control of atomic energy in accordance with the terms of reference of the United Nations Atomic Energy Commission and, approves the 'Report and Recommendations of the Atomic Energy Commission' (Part I) of the Third Report of the United Nations Atomic Energy Commission, and directs the Secretary-General to transmit to the General Assembly and to the member nations of the United Nations, the First, Second and Third Reports of the United Nations Atomic Energy Commission, together with the record of the Security Council's approval thereof."

Actually the same nations that make up the commission also constitute the Council. But the commission permits no veto, and so could approve its majority plan, nine nations to two. The only other time the Council took up the Soviet and majority deadlock, it simply took note of the first report March 10, 1947, and never attempted formally to vote it up or down.

Dr. Jessup Reaffirms America's Readiness for Bomb Disposal

This time, Dr. Jessup opened the Council debate by reaffirming the United States' readiness to "dispose of its atomic bombs, to give up all its activities in the production of dangerous quantities of atomic materials, and to turn over its knowledge of these processes to an international agency," subject to the plan developed by fourteen of the seventeen nations which had served on the commission.

"All governments," Dr. Jessup said, "are faced with one or the other of two alternatives: either a continuation of the race in atomic armaments or agreement on a system of international control in which all nations would have confidence because they believe it to be effective. There is no middle ground between these two alternatives.

"No government can fail to recognize the nature and extent of the sacrifice which would be required of them by the acceptance of an effective system of control of atomic energy to insure the prohibition of atomic weapons. Such a sacrifice seems at the moment very large.

"But in the longer view, it weighs little against the advantages of security and the benefits which will accrue to all nations by the pooling of knowledge in this field and its cooperative development for the common well-being.

"My delegation is of the opinion that the Security Council, in keeping with its responsibility, should state its position clearly. My delegation hopes that in the consideration of these matters in the Security Council and in the General Assembly, the USSR, together with all other nations, may come to recognize the soundness of the plans so painstakingly developed by the Atomic Energy Commission."

Britain and Canada Speak for Resolution; Gromyko Against It

For Great Britain, Sir Alexander Cadogan said: "The concept of sovereignty embodied in the system of national states, which has been the dominant political fact in the last few hundred years of history, is already outdated; and the lesson of this newest discovery of science is that fresh inroads must be made upon absolute sovereignty if civilization is to survive."

He called the atomic deadlock "fundamentally political," and said it was necessary at a higher level to obtain "an atmosphere of confidence without which no negotiations can result in agreement." Further detailed discussion in the commission, he said, "can indeed be worse than useless when, for example, it becomes a source both of irritation and of dangerous illusions."

For Canada, General Andrew G. L. McNaughton denied any "acceptance of defeat or of a confession of failure," and said the majority proposals were now being submitted "to the test of opinion in a wider forum." He hoped that "those who now disagree with us may yet come to share our views."

On June 16, the Soviet Union's Andrei A. Gromyko renewed the argument that the United States had tried to "drown the question of the prohibition of atomic weapons in all kinds of other insignificant questions." Mr. Gromyko said:

"The statements of some noted United States leaders who have had, or who still have, a bearing upon the formulation of the foreign policy of the United States in the field of atomic control — such as the statements of Senator McMahon or of

former Secretary of State James Byrnes, as well as the statements of the official representatives of the United States in the Atomic Energy Commission—leave no doubt that the leading circles of the United States have placed their stake upon the wrecking of the scheme of international control of atomic energy.

"They have also placed their stake upon the boosting of their production of atomic weapons, upon increased allocations of resources to that end, upon the increase of fear and instability in international relations, and upon the kindling of a war psychosis which already has affected many, particularly in the United States.

"These leading circles are in favor of continuing to clank with their atomic weapons, considering these weapons as a means to the end of applying political pressure upon other states and, in the first instance, upon the government of the USSR, although it would seem that it is about time they would understand that they cannot thus achieve the results which they consider desirable."

Mr. Gromyko attacked the United States for failing to propose time limits for stages in control, charged it aimed at control of foreign raw materials, and said it sought to interfere in the internal economic life of other nations. American proposals he said, contravene Security Council veto rights, and would transform the atomic control organ into "a police agency ...the only feature which is missing from this plan is that at the head of this agency we should place some retired American general." In view of the serious divergences between the Soviet and American views, Mr. Gromyko said: "The submission of the resolution is apparently dictated only by the search for USSR vetoes."

France Adds Her Support for Resolution

For France, Alexandre Parodi said atomic weapons and long-range bombers had revolutionized traditional concepts of security, enhancing the importance of industrial potential and increasing the vulnerability of nations. "We also see the time coming," he said, "when, even before a breach of the peace, the preparations for a future war will impose upon the few peoples still capable of such an effort burdens so great that the political, economic and social institutions which they have set up and which so far have resisted the ravages of time and war will be undermined and shaken to their foundations . . . .

"The control plan proposed by the majority constitutes a wedge driven deeply into the edifice of traditional conceptions of international relations. This plan, which may today appear a bold one, contains the true wisdom which circumstances make essential on the part of the governments."

China and Belgium Add Their Approval

For China, Dr. T. F. Tsiang said: "Many progressive scientists of the world who know the terror that lies in atomic weapons advocate the creation of a world government. In their view, traditional national sovereignty is incompatible with the existence of atomic energy. They plead with mankind that, for their very existence, all peoples must sacrifice sovereignty.

"The proposals of the majority of the commission, while limiting the exercise of national sovereignty in certain respects, are far behind the advocates of world government. What the majority has proposed is really a timid step in the limitation of national sovereignty, and we find that timid step rejected by the minority. There can be no doubt that the world will pronounce the minority to be reactionary."

Dr. Tsiang said the majority plan placed equal limits on all, and praised the United States for "a very fair" proposal. He added: "We all know that the United States is far ahead of other countries in the manufacture of atomic weapons. Without international control there is no reason to think that the United States will lose the race for atomic armaments. On the contrary, there is every reason to believe that, through its gigantic industrial equipment, the United States will continue to enjoy great advantages over the other nations."

For Belgium, Fernand Van Langenhove admitted that the majority proposals "implied the placing of considerable restrictions upon the prerogatives of national sovereignty. But the question is not whether such restrictions are considerable. It is rather whether in the absence of such restrictions it would be possible to envisage genuine security guarantees. It is equally true that the proposals of the majority imply a spirit of international cooperation which would have to be developed and pushed to a very high level. But is not this specifically the spirit from which the charter of the United Nations is inspired? Is not this the very condition for the existence of our organization?"

Osborn and Manuilsky Give Their Views; Colombia Joins Majority

On June 18, Frederick H. Osborn, American atomic delegate, told Catholic war veterans in Chicago that "Mr. Stalin would be very glad to fix it so we couldn't go to war, so long as we left it so that he could go to war." To majority delegates, Mr. Osborn said, "the Soviet plan for national operation, subject to recommendations of an international atomic agency under the veto of the Security Council, "seems like giving a blank check to any nation bent on aggression." He said the atomic problem was "being referred to the General Assembly so that the moral sanction of world opinion may be brought to bear upon the Soviet Union." He stressed that "if atomic control is to be effective, all nations must be a party to the plan."

On June 22, the Council heard Ukrainian Foreign Minister Dmitri Z. Manuilsky charge that suspending the commission would "make possible more and more effective measures for war preparations which are being carried on by official quarters in the United States of America."

He accused "official circles of the United States" of seeking world mastery and special atomic privileges. "This is as much an integral part of their scheme as is the setting up of military, naval and air bases all over the world; as is the Truman Doctrine; as is the Marshall Plan; as is the policy of the United States in Greece and its policy in China; as is the systematic violation of the charter of the United Nations by the United States.

"All these, as well as the atomic policy of the United States, are merely separate manifestations of that same integral whole which is coming to the point where it is imposing a serious threat to the peace of the world."

Mr. Manuilsky asserted the commission's technical findings were only tendentious sophistry, and said: "I should like to recall that the processes for the production and utilization of atomic energy are still a secret."

For Colombia, former Foreign Minister Roberto Urdaneta said the Big 5 alone could minimize atomic danger. Upholding the majority plan, he said: "The systems conceived among nations for the maintenance of the peace and for the safeguarding of justice are a limitation on sovereignty and always call for a decrease of the state's individual liberty." He hoped that returning the problem to the Assembly might "enable world opinion...to help the great powers to arrive at an agreement."

Soviet Veto Eliminated by Change to Procedural Resolution

On the vote, nine nations favored the American resolution—Argentina, Belgium, Canada, China, Colombia, France, Syria, United Kingdom, United States. But the Soviet Union and Ukraine voted no—and the Soviet vote was a veto.

Immediately General McNaughton moved what he called "a simple procedural resolution," as follows:

"The Security Council, having received and examined the First, the Second, and the Third Reports of the United Nations Atomic Energy Commission, directs the Secretary-General to transmit to the General Assembly and to the member nations of the United Nations, the First, Second and Third Reports of the Atomic Energy Commission, together with the record of the deliberations of the Security Council on this subject, as a matter of special concern."

Mr. Gromyko pictured complications rather than benefits in transferring the case to the Assembly. He contended the new motion was vetoable, something most members denied—but he said he wouldn't exercise a veto. The new motion was adopted, nine in favor, and the Soviet Union and Ukraine abstaining.

On June 28, in a press statement, Mr. Osborn listed Soviet arguments and offered rebuttals:

1. The Soviet wants prohibition of atomic weapons before a control treaty. "This proposal is tantamount to unilateral disarmament and is wholly unacceptable to any of the nations outside the Soviet sphere."

2. The Soviet asserts the majority plan would extend American monopoly through the world. "It is hard to understand how anyone can make this statement unless he has failed to read the First and, particularly, the Second Reports of the commission."

3. The Soviet argues the international agency would control the economic life of each nation. "This position is absolutely groundless, especially since agreement was reached on the inclusion in the treaty itself of a quota system which would provide in advance the proportion of atomic power that would be available to each nation."

4. The Soviet holds the majority plan would interfere with national sovereignty. "This argument is correct, but as is clearly stated in the Third Report, the question is not whether 'the functions and powers of the international control agency as elaborated by the majority, are politically acceptable or not...but whether governments now want effective control.'"

Condon Is Cleared by Atomic Energy Commission

(Continued from Page 226)

to investigate and report to the commission on his character, associations, and loyalty, and for the commission then to determine whether permitting him to have access to restricted data will endanger the common defense and security.

In defining the question before the commission, it is recognized that, as is the case with thousands of other persons whose security clearances must be passed on by the commission, Dr. Condon's clearance does not involve access to information on weapons or production or stockpile data, for the reason that his duties do not require that such access be given.

The five members of the Atomic Energy Commission have personally examined with care the entire record. Although its personnel security review board expressed the opinion on June 7, 1948, that action by the commission on the case might appropriately be deferred, pending reasonably prompt action by the House Committee on Un-American Activities with respect to that committee's own investigation and hearing as to Dr. Condon, the commission considers that in view of its statutory obligations this is a case which the members of the commission should themselves decide, and that it is our duty to proceed at this time to such a decision.

The record before the commission includes reports compiled in two F.B.I. investigations. In a most detailed and exhaustive manner, these present a very full picture of Dr. Condon's character, associations and loyalty, since the F.B.I. interviewed over 300 persons to obtain information and its investigations were conducted by a large number of agents on a country-wide basis. In addition, the F.B.I. supplied the commission the pertinent information relating to Dr. Condon which it had obtained from the files of other government agencies. The thorough and painstaking investigations by the F.B.I. and other relevant information available to the commission provide the basis on which it is the commission's responsibility to determine the question of Dr. Condon's security clearance.

In considering the record, the commission has found that, in the opinion of some persons, Dr. Condon's tact, judgment and discretion appear to be subject to some degree of criticism. On the other hand there are statements by persons who have been closely associated with Dr. Condon during his long work on classified information, which indicate proper care on his part in assuring that unauthorized persons should not obtain access to classified information. The file contains unfavorable information of a relevant character concerning certain persons with whom Dr. Condon and Mrs. Condon have from time to time had contacts. The file also shows that Dr. Condon is a man of wide associations, and that his associates include many highly reputable members of the scientific community who have great confidence in him.

In deciding such matters, the commission has a statutory responsibility to place in perspective the evidence both favorable and unfavorable, and to decide whether the common defense and security of the United States would be adversely affected if the individual concerned continued to have that access to restricted data which is required by the nature of his duties.

On the basis of the voluminous record before it, the members of the commission are fully satisfied that, in the terms of the statute, Dr. Condon's continued clearance for the purposes stated above "will not adversely affect the common defense and security" of the United States. The commission consider that his continued clearance is in the best interests of the atomic energy program.

Just How Important Is

THE ATOMIC BOMB?

IN these times of mounting tensions, the atomic scientists continue—as they have since the bomb fell on Hiroshima—to tell all who will listen of the social and political implications of their discoveries. Their message is increasingly important: "The responsibility to see that atomic energy is used for the benefit and not the destruction of mankind is ours—and YOURS."

THE scientists do not claim to have all the answers but they are continually exploring the relationship between science and society, between the potentialities of atomic warfare and the survival of civilization. The monthly BULLETIN OF THE ATOMIC SCIENTISTS is their medium for keeping abreast of developments in this field. It should be yours, too, if you are to participate intelligently in the democratic decisions on which our destiny may hinge.

JUST how important is the atomic bomb? The term "atomic age" seems to have drifted into our vocabulary. Its implications are too often absent from our thinking. Recent issues of the BULLETIN OF THE ATOMIC SCIENTISTS show how the problems created by atomic energy impinge on every phase of our existence.

WARFARE. In an authoritative article, "How Dangerous Are Atomic Weapons?", Edward Teller discussed the probabilities of newer, more powerful bombs, capable of producing a radioactive cloud that could endanger a continent. Austin Brues' report of his observations with the Atomic Bomb Casualty Commission described the effects of atomic bomb injuries and revealed a perviously untold story of the Japanese decision to surrender. "Atomic Bomb Explosions—Effects on an American City" by R. E. Lapp outlined the probable effects of an atomic attack on a city and examined some aspects of atomic defense.

POLITICS. A workable system for the prevention of warfare and the control of atomic energy is the only answer to the political problem posed by the atomic bomb. The BULLETIN has carried articles by R. Gordon Arneson, Quincy Wright, Warren R. Austin, Leo Szilard, Abba P. Lerner, Edward A. Shils, Cuthbert Daniel and Arthur M. Squires, Harold C. Urey, Philip Morrison and Robert R. Wilson, David E. Lilienthal, J. Robert Oppenheimer, and others, all dealing with phases of this problem. In addition, the BULLETIN carries a monthly review of United Nations developments in the field of atomic energy by Peter Kihss, New York Herald Tribune staff member and a notably astute observer of UN activities. The BULLETIN has also printed the texts or careful condensations of major documents issued by the UN and the United States Atomic Energy Commissions.

ECONOMICS. BULLETIN readers are kept informed on economic aspects of atomic energy by articles such as the authoritative report on the costs of atomic power and the economic factors which may effect its use by Sam H. Schurr, co-director of the study of Economic Aspects of Atomic Energy conducted by the Cowles Commission at the University of Chicago.

SCIENCE. Although the BULLETIN is not a technical journal, its articles on the developments in science which importantly affect our civilization have attracted wide interest and comment. Articles by H. J. Muller, Kenneth V. Thiman, Edward Teller, J. Robert Oppenheimer, Milton Burton and others have covered the field from the effects of radiation on the genes and heredity, to proposals for reorganization of research.

All these articles, and many more, dealt with problems of vital concern to you. If you missed them, you owe it to yourself as an intelligent citizen, to see that you do not miss future issues, as the BULLETIN continues its coverage of the most important problem the human race has faced since the discovery of fire.

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